

L-BAL35

Code(d) 589612  
Code(e) 591609

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.589 13<br>1.589 130 | Abbe Number $\nu_d$ | 61.15 | Dispersion $n_F - n_C$       | 0.009 634 |
| Refractive Index $n_e$ | 1.591 428             | Abbe Number $\nu_e$ | 60.93 | Dispersion $n_{F'} - n_{C'}$ | 0.009 706 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.557 75 |
| $n_{1970}$         | 1.970 09  | 1.564 07 |
| $n_{1530}$         | 1.529 58  | 1.570 69 |
| $n_{1129}$         | 1.128 64  | 1.576 22 |
| $n_t$              | 1.013 98  | 1.577 95 |
| $n_s$              | 0.852 11  | 1.580 85 |
| $n_{A'}$           | 0.768 19  | 1.582 76 |
| $n_F$              | 0.706 52  | 1.584 48 |
| $n_C$              | 0.656 27  | 1.586 18 |
| $n_{C'}$           | 0.643 85  | 1.586 65 |
| $n_{He-Ne}$        | 0.632 8   | 1.587 09 |
| $n_D$              | 0.589 29  | 1.589 04 |
| $n_d$              | 0.587 56  | 1.589 13 |
| $n_e$              | 0.546 07  | 1.591 43 |
| $n_F$              | 0.486 13  | 1.595 81 |
| $n_{F'}$           | 0.479 99  | 1.596 36 |
| $n_{He-Cd}$        | 0.441 57  | 1.600 31 |
| $n_g$              | 0.435 835 | 1.601 00 |
| $n_h$              | 0.404 656 | 1.605 28 |
| $n_i$              | 0.365 015 | 1.612 56 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 1.162 626 30E+00  |
| $A_2$                           | 3.256 610 51E-01  |
| $A_3$                           | 1.351 324 86E+00  |
| $B_1$                           | 1.259 574 37E-02  |
| $B_2$                           | -3.269 110 50E-03 |
| $B_3$                           | 1.192 145 96E+02  |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 2    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 3.2  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 100.8 |
| Rigidity Modulus G (GPa) | 40.3  |
| Poisson's Ratio $\sigma$ | 0.252 |
| Knoop Hardness Hk[Class] | 640 6 |
| Abrasion Aa              | 100   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 230 |
| $n_C - n_{A'}$      | 0.003 418 |
| $n_d - n_C$         | 0.002 952 |
| $n_e - n_C$         | 0.005 250 |
| $n_g - n_d$         | 0.011 867 |
| $n_g - n_F$         | 0.005 185 |
| $n_h - n_g$         | 0.004 288 |
| $n_i - n_g$         | 0.011 567 |
| $n_{C'} - n_t$      | 0.008 702 |
| $n_e - n_{C'}$      | 0.004 778 |
| $n_{F'} - n_e$      | 0.004 928 |
| $n_i - n_{F'}$      | 0.016 208 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.854 3 |
| $\theta_{C,A'}$              | 0.354 8 |
| $\theta_{d,C}$               | 0.306 4 |
| $\theta_{e,C}$               | 0.544 9 |
| $\theta_{g,d}$               | 1.231 8 |
| $\theta_{g,F}$               | 0.538 2 |
| $\theta_{h,g}$               | 0.445 1 |
| $\theta_{i,g}$               | 1.200 6 |
| $\theta'_{C,t}$              | 0.896 6 |
| $\theta'_{e,C'}$             | 0.492 3 |
| $\theta'_{F',e}$             | 0.507 7 |
| $\theta'_{i,F'}$             | 1.669 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.020 7  |
| $\Delta\theta_{C,A'}$ | 0.004 8  |
| $\Delta\theta_{g,d}$  | -0.005 9 |
| $\Delta\theta_{g,F}$  | -0.004 3 |
| $\Delta\theta_{i,g}$  | -0.012 4 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 345  | $\lambda_5$      | 295 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 336  | $\lambda_{0.05}$ | 300 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.23 | 0.20             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    | 0.06             |
| 310                    | 0.27             |
| 320                    | 0.53             |
| 330                    | 0.73             |
| 340                    | 0.85             |
| 350                    | 0.922            |
| 360                    | 0.956            |
| 370                    | 0.975            |
| 380                    | 0.984            |
| 390                    | 0.989            |
| 400                    | 0.992            |
| 420                    | 0.993            |
| 440                    | 0.993            |
| 460                    | 0.995            |
| 480                    | 0.996            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.991            |
| 1 600                  | 0.994            |
| 1 800                  | 0.989            |
| 2 000                  | 0.978            |
| 2 200                  | 0.934            |
| 2 400                  | 0.81             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 489  |
| Annealing Point AP (°C)                                          | 520  |
| Transformation Temperature Tg (°C)                               | 530  |
| Yield Point At (°C)                                              | 573  |
| Softening Point SP (°C)                                          | 619  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 66   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 85   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.13 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 49                                             |
| -90 ~ -80                               | 50                                             |
| -80 ~ -70                               | 52                                             |
| -70 ~ -60                               | 54                                             |
| -60 ~ -50                               | 55                                             |
| -50 ~ -40                               | 57                                             |
| -40 ~ -30                               | 58                                             |
| -30 ~ -20                               | 60                                             |
| -20 ~ -10                               | 61                                             |
| -10 ~ 0                                 | 63                                             |
| 0 ~ 10                                  | 64                                             |
| 10 ~ 20                                 | 66                                             |
| 20 ~ 30                                 | 67                                             |
| 30 ~ 40                                 | 68                                             |
| 40 ~ 50                                 | 69                                             |
| 50 ~ 60                                 | 71                                             |
| 60 ~ 70                                 | 72                                             |
| 70 ~ 80                                 | 73                                             |
| 80 ~ 90                                 | 74                                             |
| 90 ~ 100                                | 75                                             |
| 100 ~ 110                               | 77                                             |
| 110 ~ 120                               | 78                                             |
| 120 ~ 130                               | 79                                             |
| 130 ~ 140                               | 80                                             |
| 140 ~ 150                               | 81                                             |
| 150 ~ 160                               | 82                                             |
| 160 ~ 170                               | 82                                             |
| 170 ~ 180                               | 83                                             |
| 180 ~ 190                               | 84                                             |
| 190 ~ 200                               | 85                                             |
| 200 ~ 210                               | 86                                             |
| 210 ~ 220                               | 87                                             |
| 220 ~ 230                               | 87                                             |
| 230 ~ 240                               | 88                                             |
| 240 ~ 250                               | 89                                             |
| 250 ~ 260                               | 89                                             |
| 260 ~ 270                               | 90                                             |
| 270 ~ 280                               | 90                                             |
| 280 ~ 290                               | 91                                             |
| 290 ~ 300                               | 92                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.29 |
| Specific Gravity $d$                                     | 2.82 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 3.3                                                             | 3.4 | 3.7 | 3.8 | 3.8 | 3.9 | 4.1 | 4.3 | 4.3 | 4.7 | 5.0 | 5.5 |
| -60 ~ -40                                    | 3.2                                                             | 3.3 | 3.5 | 3.7 | 3.7 | 3.9 | 4.0 | 4.2 | 4.3 | 4.5 | 4.8 | 5.4 |
| -40 ~ -20                                    | 3.1                                                             | 3.3 | 3.5 | 3.6 | 3.6 | 3.9 | 4.0 | 4.2 | 4.3 | 4.6 | 4.8 | 5.4 |
| -20 ~ 0                                      | 3.2                                                             | 3.4 | 3.6 | 3.7 | 3.7 | 3.8 | 4.1 | 4.3 | 4.4 | 4.6 | 4.9 | 5.5 |
| 0 ~ 20                                       | 3.2                                                             | 3.5 | 3.7 | 3.8 | 3.8 | 4.0 | 4.1 | 4.4 | 4.4 | 4.7 | 5.0 | 5.6 |
| 20 ~ 40                                      | 3.4                                                             | 3.6 | 3.8 | 3.9 | 3.9 | 4.1 | 4.2 | 4.5 | 4.5 | 4.8 | 5.1 | 5.7 |
| 40 ~ 60                                      | 3.5                                                             | 3.6 | 3.9 | 4.0 | 4.0 | 4.1 | 4.3 | 4.5 | 4.6 | 4.9 | 5.3 | 5.8 |
| 60 ~ 80                                      | 3.6                                                             | 3.7 | 4.0 | 4.1 | 4.1 | 4.3 | 4.4 | 4.7 | 4.7 | 5.0 | 5.3 | 5.9 |
| 80 ~ 100                                     | 3.6                                                             | 3.7 | 4.1 | 4.2 | 4.2 | 4.3 | 4.5 | 4.8 | 4.8 | 5.1 | 5.4 | 6.0 |
| 100 ~ 120                                    | 3.6                                                             | 3.9 | 4.2 | 4.3 | 4.3 | 4.4 | 4.6 | 4.8 | 4.9 | 5.2 | 5.5 | 6.1 |
| 120 ~ 140                                    | 3.7                                                             | 3.9 | 4.2 | 4.3 | 4.3 | 4.4 | 4.6 | 4.9 | 4.9 | 5.2 | 5.5 | 6.1 |
| 140 ~ 160                                    | 3.7                                                             | 3.9 | 4.2 | 4.3 | 4.3 | 4.4 | 4.6 | 4.9 | 4.9 | 5.2 | 5.5 | 6.2 |
| 160 ~ 180                                    | 3.7                                                             | 3.8 | 4.1 | 4.3 | 4.3 | 4.5 | 4.5 | 4.9 | 5.0 | 5.3 | 5.6 | 6.2 |

## L-BAL35P

Code(d) 592610

Code(e) 594608

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.592 08<br>1.592 080 | Abbe Number $\nu_d$ | 61.00 | Dispersion $n_F - n_C$       | 0.009 707 |
| Refractive Index $n_e$ | 1.594 396             | Abbe Number $\nu_e$ | 60.77 | Dispersion $n_{F'} - n_{C'}$ | 0.009 781 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.560 51 |
| $n_{1970}$         | 1.970 09  | 1.566 87 |
| $n_{1530}$         | 1.529 58  | 1.573 53 |
| $n_{1129}$         | 1.128 64  | 1.579 08 |
| $n_t$              | 1.013 98  | 1.580 82 |
| $n_s$              | 0.852 11  | 1.583 73 |
| $n_{A'}$           | 0.768 19  | 1.585 66 |
| $n_F$              | 0.706 52  | 1.587 40 |
| $n_C$              | 0.656 27  | 1.589 11 |
| $n_{C'}$           | 0.643 85  | 1.589 58 |
| $n_{He-Ne}$        | 0.632 8   | 1.590 02 |
| $n_D$              | 0.589 29  | 1.591 99 |
| $n_d$              | 0.587 56  | 1.592 08 |
| $n_e$              | 0.546 07  | 1.594 40 |
| $n_F$              | 0.486 13  | 1.598 81 |
| $n_{F'}$           | 0.479 99  | 1.599 36 |
| $n_{He-Cd}$        | 0.441 57  | 1.603 35 |
| $n_g$              | 0.435 835 | 1.604 04 |
| $n_h$              | 0.404 656 | 1.608 36 |
| $n_i$              | 0.365 015 | 1.615 70 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 8.067 421 94E-01 |
| $A_2$                           | 6.904 886 48E-01 |
| $A_3$                           | 1.264 779 47E+00 |
| $B_1$                           | 1.488 362 31E-02 |
| $B_2$                           | 2.519 430 58E-03 |
| $B_3$                           | 1.113 145 70E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 2    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 3.2  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 100.8 |
| Rigidity Modulus G (GPa) | 40.3  |
| Poisson's Ratio $\sigma$ | 0.252 |
| Knoop Hardness Hk[Class] | 630 6 |
| Abrasion Aa              | 100   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 288 |
| $n_C - n_{A'}$      | 0.003 444 |
| $n_d - n_C$         | 0.002 974 |
| $n_e - n_C$         | 0.005 290 |
| $n_g - n_d$         | 0.011 957 |
| $n_g - n_F$         | 0.005 224 |
| $n_h - n_g$         | 0.004 322 |
| $n_i - n_g$         | 0.011 660 |
| $n_{C'} - n_t$      | 0.008 763 |
| $n_e - n_{C'}$      | 0.004 815 |
| $n_{F'} - n_e$      | 0.004 966 |
| $n_i - n_{F'}$      | 0.016 335 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.853 8 |
| $\theta_{C,A'}$              | 0.354 8 |
| $\theta_{d,C}$               | 0.306 4 |
| $\theta_{e,C}$               | 0.545 0 |
| $\theta_{g,d}$               | 1.231 8 |
| $\theta_{g,F}$               | 0.538 2 |
| $\theta_{h,g}$               | 0.445 2 |
| $\theta_{i,g}$               | 1.201 2 |
| $\theta'_{C,t}$              | 0.895 9 |
| $\theta'_{e,C'}$             | 0.492 3 |
| $\theta'_{F,e}$              | 0.507 7 |
| $\theta'_{i,F'}$             | 1.670 1 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.020 9  |
| $\Delta\theta_{C,A'}$ | 0.005 0  |
| $\Delta\theta_{g,d}$  | -0.006 2 |
| $\Delta\theta_{g,F}$  | -0.004 6 |
| $\Delta\theta_{i,g}$  | -0.013 0 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 345  | $\lambda_5$      | 295 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 336  | $\lambda_{0.05}$ | 300 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.23 | 0.20             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    | 0.06             |
| 310                    | 0.27             |
| 320                    | 0.53             |
| 330                    | 0.73             |
| 340                    | 0.85             |
| 350                    | 0.922            |
| 360                    | 0.956            |
| 370                    | 0.975            |
| 380                    | 0.984            |
| 390                    | 0.989            |
| 400                    | 0.992            |
| 420                    | 0.993            |
| 440                    | 0.993            |
| 460                    | 0.995            |
| 480                    | 0.996            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.991            |
| 1 600                  | 0.994            |
| 1 800                  | 0.989            |
| 2 000                  | 0.978            |
| 2 200                  | 0.934            |
| 2 400                  | 0.81             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 489  |
| Annealing Point AP (°C)                                          | 520  |
| Transformation Temperature Tg (°C)                               | 531  |
| Yield Point At (°C)                                              | 575  |
| Softening Point SP (°C)                                          | 619  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 66   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 86   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.13 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 49                                             |
| -90 ~ -80                               | 51                                             |
| -80 ~ -70                               | 52                                             |
| -70 ~ -60                               | 54                                             |
| -60 ~ -50                               | 56                                             |
| -50 ~ -40                               | 57                                             |
| -40 ~ -30                               | 59                                             |
| -30 ~ -20                               | 60                                             |
| -20 ~ -10                               | 62                                             |
| -10 ~ 0                                 | 63                                             |
| 0 ~ 10                                  | 64                                             |
| 10 ~ 20                                 | 66                                             |
| 20 ~ 30                                 | 67                                             |
| 30 ~ 40                                 | 69                                             |
| 40 ~ 50                                 | 70                                             |
| 50 ~ 60                                 | 71                                             |
| 60 ~ 70                                 | 72                                             |
| 70 ~ 80                                 | 74                                             |
| 80 ~ 90                                 | 75                                             |
| 90 ~ 100                                | 76                                             |
| 100 ~ 110                               | 77                                             |
| 110 ~ 120                               | 78                                             |
| 120 ~ 130                               | 79                                             |
| 130 ~ 140                               | 80                                             |
| 140 ~ 150                               | 81                                             |
| 150 ~ 160                               | 82                                             |
| 160 ~ 170                               | 83                                             |
| 170 ~ 180                               | 84                                             |
| 180 ~ 190                               | 85                                             |
| 190 ~ 200                               | 86                                             |
| 200 ~ 210                               | 87                                             |
| 210 ~ 220                               | 88                                             |
| 220 ~ 230                               | 88                                             |
| 230 ~ 240                               | 89                                             |
| 240 ~ 250                               | 90                                             |
| 250 ~ 260                               | 91                                             |
| 260 ~ 270                               | 91                                             |
| 270 ~ 280                               | 92                                             |
| 280 ~ 290                               | 93                                             |
| 290 ~ 300                               | 93                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.29 |
| Specific Gravity $d$                                     | 2.82 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 3.3                                                             | 3.4 | 3.7 | 3.8 | 3.8 | 3.9 | 4.0 | 4.2 | 4.2 | 4.5 | 4.8 | 5.2 |
| -60 ~ -40                                    | 3.2                                                             | 3.3 | 3.5 | 3.7 | 3.7 | 3.8 | 3.9 | 4.1 | 4.2 | 4.4 | 4.6 | 5.2 |
| -40 ~ -20                                    | 3.2                                                             | 3.3 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.1 | 4.2 | 4.4 | 4.7 | 5.3 |
| -20 ~ 0                                      | 3.2                                                             | 3.3 | 3.5 | 3.6 | 3.6 | 3.8 | 4.0 | 4.2 | 4.2 | 4.5 | 4.8 | 5.3 |
| 0 ~ 20                                       | 3.2                                                             | 3.4 | 3.7 | 3.7 | 3.8 | 3.9 | 4.0 | 4.3 | 4.3 | 4.6 | 4.9 | 5.5 |
| 20 ~ 40                                      | 3.4                                                             | 3.5 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.4 | 4.4 | 4.7 | 5.0 | 5.7 |
| 40 ~ 60                                      | 3.4                                                             | 3.5 | 3.8 | 3.9 | 3.9 | 4.0 | 4.2 | 4.5 | 4.5 | 4.9 | 5.2 | 5.8 |
| 60 ~ 80                                      | 3.5                                                             | 3.6 | 3.9 | 4.0 | 4.0 | 4.2 | 4.3 | 4.6 | 4.7 | 5.0 | 5.3 | 5.9 |
| 80 ~ 100                                     | 3.5                                                             | 3.6 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.7 | 4.8 | 5.1 | 5.5 | 6.1 |
| 100 ~ 120                                    | 3.6                                                             | 3.8 | 4.1 | 4.2 | 4.2 | 4.4 | 4.5 | 4.8 | 4.9 | 5.2 | 5.6 | 6.2 |
| 120 ~ 140                                    | 3.6                                                             | 3.8 | 4.1 | 4.2 | 4.3 | 4.4 | 4.6 | 4.9 | 4.9 | 5.3 | 5.7 | 6.4 |
| 140 ~ 160                                    | 3.6                                                             | 3.8 | 4.2 | 4.3 | 4.3 | 4.5 | 4.6 | 5.0 | 5.0 | 5.4 | 5.8 | 6.6 |
| 160 ~ 180                                    | 3.6                                                             | 3.8 | 4.1 | 4.3 | 4.4 | 4.5 | 4.7 | 5.0 | 5.1 | 5.5 | 5.9 | 6.6 |

OHARA 25-04

L-BAL42

Code(d) 583594  
Code(e) 585591

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.583 13<br>1.583 126 | Abbe Number $\nu_d$ | 59.38 | Dispersion $n_F - n_C$       | 0.009 820 |
| Refractive Index $n_e$ | 1.585 468             | Abbe Number $\nu_e$ | 59.13 | Dispersion $n_{F'} - n_{C'}$ | 0.009 901 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.554 02 |
| $n_{1970}$         | 1.970 09  | 1.559 49 |
| $n_{1530}$         | 1.529 58  | 1.565 33 |
| $n_{1129}$         | 1.128 64  | 1.570 38 |
| $n_t$              | 1.013 98  | 1.572 01 |
| $n_s$              | 0.852 11  | 1.574 82 |
| $n_{A'}$           | 0.768 19  | 1.576 71 |
| $n_F$              | 0.706 52  | 1.578 43 |
| $n_C$              | 0.656 27  | 1.580 13 |
| $n_{C'}$           | 0.643 85  | 1.580 61 |
| $n_{He-Ne}$        | 0.632 8   | 1.581 06 |
| $n_D$              | 0.589 29  | 1.583 04 |
| $n_d$              | 0.587 56  | 1.583 13 |
| $n_e$              | 0.546 07  | 1.585 47 |
| $n_F$              | 0.486 13  | 1.589 95 |
| $n_{F'}$           | 0.479 99  | 1.590 51 |
| $n_{He-Cd}$        | 0.441 57  | 1.594 57 |
| $n_g$              | 0.435 835 | 1.595 28 |
| $n_h$              | 0.404 656 | 1.599 69 |
| $n_i$              | 0.365 015 | 1.607 19 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 1.395 280 97E+00  |
| $A_2$                           | 7.255 195 20E-02  |
| $A_3$                           | 1.663 358 48E+00  |
| $B_1$                           | 1.118 620 30E-02  |
| $B_2$                           | -2.467 485 75E-02 |
| $B_3$                           | 1.677 179 58E+02  |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 5,2 |
| Phosphate Resistance PR                   | 2,0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 89.1  |
| Rigidity Modulus G (GPa) | 35.7  |
| Poisson's Ratio $\sigma$ | 0.247 |
| Knoop Hardness Hk[Class] | 590 6 |
| Abrasion Aa              | 117   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 122 |
| $n_C - n_{A'}$      | 0.003 426 |
| $n_d - n_C$         | 0.002 992 |
| $n_e - n_C$         | 0.005 334 |
| $n_g - n_d$         | 0.012 153 |
| $n_g - n_F$         | 0.005 325 |
| $n_h - n_g$         | 0.004 412 |
| $n_i - n_g$         | 0.011 910 |
| $n_{C'} - n_t$      | 0.008 599 |
| $n_e - n_{C'}$      | 0.004 857 |
| $n_{F'} - n_e$      | 0.005 044 |
| $n_i - n_{F'}$      | 0.016 677 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.827 1 |
| $\theta_{C,A'}$              | 0.348 9 |
| $\theta_{d,C}$               | 0.304 7 |
| $\theta_{e,C}$               | 0.543 2 |
| $\theta_{g,d}$               | 1.237 6 |
| $\theta_{g,F}$               | 0.542 3 |
| $\theta_{h,g}$               | 0.449 3 |
| $\theta_{i,g}$               | 1.212 8 |
| $\theta'_{C,t}$              | 0.868 5 |
| $\theta'_{e,C'}$             | 0.490 6 |
| $\theta'_{F,e}$              | 0.509 4 |
| $\theta'_{i,F'}$             | 1.684 4 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.001 8  |
| $\Delta\theta_{C,A'}$ | 0.001 0  |
| $\Delta\theta_{g,d}$  | -0.003 8 |
| $\Delta\theta_{g,F}$  | -0.003 1 |
| $\Delta\theta_{i,g}$  | -0.015 0 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 340  | $\lambda_5$      | 285 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 326  | $\lambda_{0.05}$ | 282 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.17 | 0.14             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.03             |
| 290                    | 0.14             |
| 300                    | 0.32             |
| 310                    | 0.55             |
| 320                    | 0.73             |
| 330                    | 0.85             |
| 340                    | 0.924            |
| 350                    | 0.960            |
| 360                    | 0.978            |
| 370                    | 0.987            |
| 380                    | 0.992            |
| 390                    | 0.994            |
| 400                    | 0.995            |
| 420                    | 0.996            |
| 440                    | 0.996            |
| 460                    | 0.996            |
| 480                    | 0.998            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.988            |
| 1 600                  | 0.993            |
| 1 800                  | 0.983            |
| 2 000                  | 0.968            |
| 2 200                  | 0.901            |
| 2 400                  | 0.83             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 467  |
| Annealing Point AP (°C)                                          | 494  |
| Transformation Temperature Tg (°C)                               | 502  |
| Yield Point At (°C)                                              | 551  |
| Softening Point SP (°C)                                          | 607  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 72   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 92   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.03 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 55                                             |
| -90 ~ -80                               | 57                                             |
| -80 ~ -70                               | 58                                             |
| -70 ~ -60                               | 60                                             |
| -60 ~ -50                               | 61                                             |
| -50 ~ -40                               | 63                                             |
| -40 ~ -30                               | 64                                             |
| -30 ~ -20                               | 66                                             |
| -20 ~ -10                               | 67                                             |
| -10 ~ 0                                 | 69                                             |
| 0 ~ 10                                  | 70                                             |
| 10 ~ 20                                 | 72                                             |
| 20 ~ 30                                 | 73                                             |
| 30 ~ 40                                 | 74                                             |
| 40 ~ 50                                 | 75                                             |
| 50 ~ 60                                 | 77                                             |
| 60 ~ 70                                 | 78                                             |
| 70 ~ 80                                 | 79                                             |
| 80 ~ 90                                 | 80                                             |
| 90 ~ 100                                | 82                                             |
| 100 ~ 110                               | 83                                             |
| 110 ~ 120                               | 84                                             |
| 120 ~ 130                               | 85                                             |
| 130 ~ 140                               | 86                                             |
| 140 ~ 150                               | 87                                             |
| 150 ~ 160                               | 88                                             |
| 160 ~ 170                               | 89                                             |
| 170 ~ 180                               | 90                                             |
| 180 ~ 190                               | 91                                             |
| 190 ~ 200                               | 92                                             |
| 200 ~ 210                               | 93                                             |
| 210 ~ 220                               | 94                                             |
| 220 ~ 230                               | 94                                             |
| 230 ~ 240                               | 95                                             |
| 240 ~ 250                               | 96                                             |
| 250 ~ 260                               | 97                                             |
| 260 ~ 270                               | 98                                             |
| 270 ~ 280                               | 98                                             |
| 280 ~ 290                               | 99                                             |
| 290 ~ 300                               | 100                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.19 |
| Specific Gravity $d$                                     | 3.05 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.5                                                             | 2.6 | 2.9 | 3.0 | 3.0 | 3.1 | 3.3 | 3.5 | 3.5 | 3.9 | 4.1 | 4.6 |
| -60 ~ -40                                    | 2.3                                                             | 2.5 | 2.7 | 2.8 | 2.8 | 3.0 | 3.1 | 3.4 | 3.4 | 3.7 | 4.0 | 4.6 |
| -40 ~ -20                                    | 2.3                                                             | 2.4 | 2.6 | 2.7 | 2.8 | 3.0 | 3.1 | 3.4 | 3.4 | 3.7 | 4.0 | 4.5 |
| -20 ~ 0                                      | 2.3                                                             | 2.4 | 2.7 | 2.7 | 2.8 | 2.9 | 3.1 | 3.4 | 3.4 | 3.8 | 4.1 | 4.6 |
| 0 ~ 20                                       | 2.2                                                             | 2.5 | 2.8 | 2.8 | 2.9 | 3.0 | 3.2 | 3.4 | 3.5 | 3.8 | 4.1 | 4.8 |
| 20 ~ 40                                      | 2.4                                                             | 2.5 | 2.8 | 2.9 | 2.9 | 3.1 | 3.2 | 3.5 | 3.6 | 3.9 | 4.2 | 5.0 |
| 40 ~ 60                                      | 2.4                                                             | 2.6 | 2.9 | 3.0 | 3.0 | 3.1 | 3.3 | 3.6 | 3.6 | 4.0 | 4.4 | 5.1 |
| 60 ~ 80                                      | 2.5                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.3 | 3.4 | 3.8 | 3.8 | 4.2 | 4.5 | 5.2 |
| 80 ~ 100                                     | 2.5                                                             | 2.7 | 3.1 | 3.2 | 3.2 | 3.4 | 3.6 | 3.9 | 3.9 | 4.3 | 4.7 | 5.4 |
| 100 ~ 120                                    | 2.5                                                             | 2.8 | 3.2 | 3.3 | 3.3 | 3.5 | 3.6 | 4.0 | 4.0 | 4.4 | 4.8 | 5.5 |
| 120 ~ 140                                    | 2.7                                                             | 2.9 | 3.2 | 3.3 | 3.3 | 3.5 | 3.7 | 4.1 | 4.1 | 4.5 | 4.9 | 5.6 |
| 140 ~ 160                                    | 2.7                                                             | 2.9 | 3.2 | 3.3 | 3.4 | 3.6 | 3.7 | 4.1 | 4.2 | 4.6 | 5.0 | 5.8 |
| 160 ~ 180                                    | 2.7                                                             | 2.9 | 3.2 | 3.3 | 3.4 | 3.7 | 3.9 | 4.2 | 4.3 | 4.7 | 5.1 | 5.9 |

# L-BAL42P

Code(d) **586592**  
Code(e) **588590**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.585 93</b><br>1.585 930 | Abbe Number $\nu_d$ | <b>59.24</b> | Dispersion $n_F - n_C$       | <b>0.009 890</b> |
| Refractive Index $n_e$ | 1.588 288                    | Abbe Number $\nu_e$ | 58.99        | Dispersion $n_{F'} - n_{C'}$ | 0.009 972        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.556 71 |
| $n_{1970}$         | 1.970 09  | 1.562 22 |
| $n_{1530}$         | 1.529 58  | 1.568 06 |
| $n_{1129}$         | 1.128 64  | 1.573 11 |
| $n_t$              | 1.013 98  | 1.574 75 |
| $n_s$              | 0.852 11  | 1.577 57 |
| $n_{A'}$           | 0.768 19  | 1.579 47 |
| $n_F$              | 0.706 52  | 1.581 20 |
| $n_C$              | 0.656 27  | 1.582 92 |
| $n_{C'}$           | 0.643 85  | 1.583 40 |
| $n_{He-Ne}$        | 0.632 8   | 1.583 85 |
| $n_D$              | 0.589 29  | 1.585 84 |
| $n_d$              | 0.587 56  | 1.585 93 |
| $n_e$              | 0.546 07  | 1.588 29 |
| $n_F$              | 0.486 13  | 1.592 81 |
| $n_{F'}$           | 0.479 99  | 1.593 37 |
| $n_{He-Cd}$        | 0.441 57  | 1.597 46 |
| $n_g$              | 0.435 835 | 1.598 17 |
| $n_h$              | 0.404 656 | 1.602 62 |
| $n_i$              | 0.365 015 | 1.610 20 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 8.810 900 17E-01 |
| $A_2$                           | 5.950 388 59E-01 |
| $A_3$                           | 1.225 820 98E+00 |
| $B_1$                           | 1.484 966 55E-02 |
| $B_2$                           | 1.635 773 71E-03 |
| $B_3$                           | 1.251 137 20E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 5,2 |
| Phosphate Resistance PR                   | 2,0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 89.1  |
| Rigidity Modulus G (GPa) | 35.7  |
| Poisson's Ratio $\sigma$ | 0.247 |
| Knoop Hardness Hk[Class] | 590   |
| Abrasion Aa              | 117   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 169 |
| $n_C - n_{A'}$      | 0.003 449 |
| $n_d - n_C$         | 0.003 013 |
| $n_e - n_C$         | 0.005 371 |
| $n_g - n_d$         | 0.012 242 |
| $n_g - n_F$         | 0.005 365 |
| $n_h - n_g$         | 0.004 451 |
| $n_i - n_g$         | 0.012 026 |
| $n_{C'} - n_t$      | 0.008 649 |
| $n_e - n_{C'}$      | 0.004 891 |
| $n_{F'} - n_e$      | 0.005 081 |
| $n_i - n_{F'}$      | 0.016 829 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.826 0 |
| $\theta_{C,A'}$              | 0.348 7 |
| $\theta_{d,C}$               | 0.304 7 |
| $\theta_{e,C}$               | 0.543 1 |
| $\theta_{g,d}$               | 1.237 8 |
| $\theta_{g,F}$               | 0.542 5 |
| $\theta_{h,g}$               | 0.450 1 |
| $\theta_{i,g}$               | 1.216 0 |
| $\theta'_{C,t}$              | 0.867 3 |
| $\theta'_{e,C'}$             | 0.490 5 |
| $\theta'_{F,e}$              | 0.509 5 |
| $\theta'_{i,F'}$             | 1.687 6 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.001 4  |
| $\Delta\theta_{C,A'}$ | 0.001 0  |
| $\Delta\theta_{g,d}$  | -0.003 9 |
| $\Delta\theta_{g,F}$  | -0.003 1 |
| $\Delta\theta_{i,g}$  | -0.013 0 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 340  | $\lambda_5$      | 285 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 326  | $\lambda_{0.05}$ | 282 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.17 | 0.14             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.03             |
| 290                    | 0.14             |
| 300                    | 0.32             |
| 310                    | 0.55             |
| 320                    | 0.73             |
| 330                    | 0.85             |
| 340                    | 0.924            |
| 350                    | 0.960            |
| 360                    | 0.978            |
| 370                    | 0.987            |
| 380                    | 0.992            |
| 390                    | 0.994            |
| 400                    | 0.995            |
| 420                    | 0.996            |
| 440                    | 0.996            |
| 460                    | 0.996            |
| 480                    | 0.998            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.988            |
| 1 600                  | 0.993            |
| 1 800                  | 0.983            |
| 2 000                  | 0.968            |
| 2 200                  | 0.901            |
| 2 400                  | 0.83             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 467  |
| Annealing Point AP (°C)                                          | 494  |
| Transformation Temperature Tg (°C)                               | 502  |
| Yield Point At (°C)                                              | 551  |
| Softening Point SP (°C)                                          | 607  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 73   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 93   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.03 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 56                                             |
| -90 ~ -80                               | 57                                             |
| -80 ~ -70                               | 59                                             |
| -70 ~ -60                               | 61                                             |
| -60 ~ -50                               | 62                                             |
| -50 ~ -40                               | 64                                             |
| -40 ~ -30                               | 65                                             |
| -30 ~ -20                               | 67                                             |
| -20 ~ -10                               | 68                                             |
| -10 ~ 0                                 | 70                                             |
| 0 ~ 10                                  | 71                                             |
| 10 ~ 20                                 | 72                                             |
| 20 ~ 30                                 | 74                                             |
| 30 ~ 40                                 | 75                                             |
| 40 ~ 50                                 | 77                                             |
| 50 ~ 60                                 | 78                                             |
| 60 ~ 70                                 | 79                                             |
| 70 ~ 80                                 | 80                                             |
| 80 ~ 90                                 | 82                                             |
| 90 ~ 100                                | 83                                             |
| 100 ~ 110                               | 84                                             |
| 110 ~ 120                               | 85                                             |
| 120 ~ 130                               | 86                                             |
| 130 ~ 140                               | 87                                             |
| 140 ~ 150                               | 88                                             |
| 150 ~ 160                               | 89                                             |
| 160 ~ 170                               | 90                                             |
| 170 ~ 180                               | 91                                             |
| 180 ~ 190                               | 92                                             |
| 190 ~ 200                               | 93                                             |
| 200 ~ 210                               | 94                                             |
| 210 ~ 220                               | 95                                             |
| 220 ~ 230                               | 96                                             |
| 230 ~ 240                               | 97                                             |
| 240 ~ 250                               | 98                                             |
| 250 ~ 260                               | 98                                             |
| 260 ~ 270                               | 99                                             |
| 270 ~ 280                               | 100                                            |
| 280 ~ 290                               | 100                                            |
| 290 ~ 300                               | 101                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.19 |
| Specific Gravity $d$                                     | 3.05 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.5                                                             | 2.6 | 3.0 | 3.0 | 3.0 | 3.2 | 3.3 | 3.5 | 3.5 | 3.9 | 4.2 | 4.7 |
| -60 ~ -40                                    | 2.4                                                             | 2.5 | 2.7 | 2.8 | 2.8 | 3.0 | 3.2 | 3.4 | 3.4 | 3.7 | 4.0 | 4.7 |
| -40 ~ -20                                    | 2.3                                                             | 2.4 | 2.7 | 2.7 | 2.8 | 3.0 | 3.1 | 3.4 | 3.4 | 3.7 | 4.0 | 4.6 |
| -20 ~ 0                                      | 2.3                                                             | 2.4 | 2.7 | 2.8 | 2.8 | 2.9 | 3.1 | 3.4 | 3.4 | 3.8 | 4.1 | 4.7 |
| 0 ~ 20                                       | 2.3                                                             | 2.5 | 2.8 | 2.9 | 2.9 | 3.0 | 3.2 | 3.4 | 3.5 | 3.8 | 4.1 | 4.8 |
| 20 ~ 40                                      | 2.3                                                             | 2.6 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.5 | 3.6 | 3.9 | 4.2 | 5.0 |
| 40 ~ 60                                      | 2.4                                                             | 2.6 | 2.9 | 3.0 | 3.0 | 3.1 | 3.3 | 3.6 | 3.6 | 4.0 | 4.4 | 5.1 |
| 60 ~ 80                                      | 2.5                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.3 | 3.4 | 3.7 | 3.8 | 4.1 | 4.5 | 5.2 |
| 80 ~ 100                                     | 2.5                                                             | 2.7 | 3.1 | 3.2 | 3.2 | 3.4 | 3.5 | 3.8 | 3.9 | 4.3 | 4.6 | 5.3 |
| 100 ~ 120                                    | 2.6                                                             | 2.8 | 3.2 | 3.3 | 3.3 | 3.5 | 3.6 | 4.0 | 4.0 | 4.4 | 4.8 | 5.5 |
| 120 ~ 140                                    | 2.7                                                             | 2.9 | 3.2 | 3.3 | 3.4 | 3.5 | 3.7 | 4.0 | 4.1 | 4.5 | 4.8 | 5.6 |
| 140 ~ 160                                    | 2.7                                                             | 2.9 | 3.2 | 3.4 | 3.4 | 3.5 | 3.7 | 4.1 | 4.1 | 4.5 | 4.9 | 5.8 |
| 160 ~ 180                                    | 2.7                                                             | 2.9 | 3.2 | 3.4 | 3.4 | 3.7 | 3.8 | 4.2 | 4.2 | 4.7 | 5.1 | 5.8 |

OHARA 25-04

L-BAL43

Code(d) 586597  
Code(e) 588594

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.585 73<br>1.585 730 | Abbe Number $\nu_d$ | 59.70 | Dispersion $n_F - n_C$       | 0.009 812 |
| Refractive Index $n_e$ | 1.588 070             | Abbe Number $\nu_e$ | 59.45 | Dispersion $n_{F'} - n_{C'}$ | 0.009 892 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.556 21 |
| $n_{1970}$         | 1.970 09  | 1.561 85 |
| $n_{1530}$         | 1.529 58  | 1.567 81 |
| $n_{1129}$         | 1.128 64  | 1.572 93 |
| $n_t$              | 1.013 98  | 1.574 58 |
| $n_s$              | 0.852 11  | 1.577 40 |
| $n_{A'}$           | 0.768 19  | 1.579 30 |
| $n_F$              | 0.706 52  | 1.581 03 |
| $n_C$              | 0.656 27  | 1.582 74 |
| $n_{C'}$           | 0.643 85  | 1.583 21 |
| $n_{He-Ne}$        | 0.632 8   | 1.583 66 |
| $n_D$              | 0.589 29  | 1.585 64 |
| $n_d$              | 0.587 56  | 1.585 73 |
| $n_e$              | 0.546 07  | 1.588 07 |
| $n_F$              | 0.486 13  | 1.592 55 |
| $n_{F'}$           | 0.479 99  | 1.593 11 |
| $n_{He-Cd}$        | 0.441 57  | 1.597 16 |
| $n_g$              | 0.435 835 | 1.597 86 |
| $n_h$              | 0.404 656 | 1.602 27 |
| $n_i$              | 0.365 015 | 1.609 76 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.047 452 91E+00 |
| $A_2$                           | 4.284 528 73E-01 |
| $A_3$                           | 1.141 113 03E+00 |
| $B_1$                           | 5.632 097 56E-03 |
| $B_2$                           | 1.883 214 16E-02 |
| $B_3$                           | 1.141 970 69E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 51.4 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 90.4  |
| Rigidity Modulus G (GPa) | 36.2  |
| Poisson's Ratio $\sigma$ | 0.250 |
| Knoop Hardness Hk[Class] | 600 6 |
| Abrasion Aa              | 118   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 157 |
| $n_C - n_{A'}$      | 0.003 435 |
| $n_d - n_C$         | 0.002 993 |
| $n_e - n_C$         | 0.005 333 |
| $n_g - n_d$         | 0.012 132 |
| $n_g - n_F$         | 0.005 313 |
| $n_h - n_g$         | 0.004 404 |
| $n_i - n_g$         | 0.011 900 |
| $n_{C'} - n_t$      | 0.008 634 |
| $n_e - n_{C'}$      | 0.004 856 |
| $n_{F'} - n_e$      | 0.005 036 |
| $n_i - n_{F'}$      | 0.016 656 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.831 3 |
| $\theta_{C,A'}$              | 0.350 1 |
| $\theta_{d,C}$               | 0.305 0 |
| $\theta_{e,C}$               | 0.543 5 |
| $\theta_{g,d}$               | 1.236 4 |
| $\theta_{g,F}$               | 0.541 5 |
| $\theta_{h,g}$               | 0.448 8 |
| $\theta_{i,g}$               | 1.212 8 |
| $\theta'_{C,t}$              | 0.872 8 |
| $\theta'_{e,C'}$             | 0.490 9 |
| $\theta'_{F',e}$             | 0.509 1 |
| $\theta'_{i,F'}$             | 1.683 8 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.004 5  |
| $\Delta\theta_{C,A'}$ | 0.001 9  |
| $\Delta\theta_{g,d}$  | -0.004 3 |
| $\Delta\theta_{g,F}$  | -0.003 4 |
| $\Delta\theta_{i,g}$  | -0.012 3 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 340  | $\lambda_5$      | 285 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 328  | $\lambda_{0.05}$ | 289 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.10 | 0.10             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    | 0.29             |
| 310                    | 0.51             |
| 320                    | 0.70             |
| 330                    | 0.83             |
| 340                    | 0.906            |
| 350                    | 0.949            |
| 360                    | 0.971            |
| 370                    | 0.983            |
| 380                    | 0.988            |
| 390                    | 0.990            |
| 400                    | 0.996            |
| 420                    | 0.997            |
| 440                    | 0.996            |
| 460                    | 0.998            |
| 480                    | 0.999            |
| 500                    | 0.999            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.993            |
| 1 600                  | 0.997            |
| 1 800                  | 0.988            |
| 2 000                  | 0.975            |
| 2 200                  | 0.914            |
| 2 400                  | 0.84             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 451  |
| Annealing Point AP (°C)                                          | 482  |
| Transformation Temperature Tg (°C)                               | 506  |
| Yield Point At (°C)                                              | 549  |
| Softening Point SP (°C)                                          | 596  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 73   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 93   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.03 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 56                                             |
| -90 ~ -80                               | 58                                             |
| -80 ~ -70                               | 59                                             |
| -70 ~ -60                               | 61                                             |
| -60 ~ -50                               | 63                                             |
| -50 ~ -40                               | 64                                             |
| -40 ~ -30                               | 66                                             |
| -30 ~ -20                               | 67                                             |
| -20 ~ -10                               | 68                                             |
| -10 ~ 0                                 | 70                                             |
| 0 ~ 10                                  | 71                                             |
| 10 ~ 20                                 | 73                                             |
| 20 ~ 30                                 | 74                                             |
| 30 ~ 40                                 | 75                                             |
| 40 ~ 50                                 | 77                                             |
| 50 ~ 60                                 | 78                                             |
| 60 ~ 70                                 | 79                                             |
| 70 ~ 80                                 | 80                                             |
| 80 ~ 90                                 | 81                                             |
| 90 ~ 100                                | 83                                             |
| 100 ~ 110                               | 84                                             |
| 110 ~ 120                               | 85                                             |
| 120 ~ 130                               | 86                                             |
| 130 ~ 140                               | 87                                             |
| 140 ~ 150                               | 88                                             |
| 150 ~ 160                               | 89                                             |
| 160 ~ 170                               | 90                                             |
| 170 ~ 180                               | 91                                             |
| 180 ~ 190                               | 92                                             |
| 190 ~ 200                               | 93                                             |
| 200 ~ 210                               | 94                                             |
| 210 ~ 220                               | 95                                             |
| 220 ~ 230                               | 96                                             |
| 230 ~ 240                               | 96                                             |
| 240 ~ 250                               | 97                                             |
| 250 ~ 260                               | 98                                             |
| 260 ~ 270                               | 99                                             |
| 270 ~ 280                               | 99                                             |
| 280 ~ 290                               | 100                                            |
| 290 ~ 300                               | 101                                            |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 2.18 |
| Specific Gravity $d$                        | 3.05 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.5                                                             | 2.6 | 3.0 | 3.0 | 3.1 | 3.2 | 3.3 | 3.5 | 3.5 | 3.8 | 4.2 | 4.6 |
| -60 ~ -40                                    | 2.4                                                             | 2.5 | 2.7 | 2.8 | 2.8 | 3.1 | 3.2 | 3.4 | 3.5 | 3.7 | 4.0 | 4.6 |
| -40 ~ -20                                    | 2.3                                                             | 2.4 | 2.7 | 2.8 | 2.8 | 3.0 | 3.1 | 3.4 | 3.4 | 3.7 | 4.0 | 4.5 |
| -20 ~ 0                                      | 2.3                                                             | 2.4 | 2.7 | 2.8 | 2.8 | 3.0 | 3.2 | 3.5 | 3.5 | 3.8 | 4.1 | 4.7 |
| 0 ~ 20                                       | 2.3                                                             | 2.5 | 2.8 | 2.9 | 2.9 | 3.1 | 3.2 | 3.5 | 3.5 | 3.9 | 4.2 | 4.9 |
| 20 ~ 40                                      | 2.3                                                             | 2.6 | 2.9 | 3.0 | 3.0 | 3.2 | 3.3 | 3.6 | 3.7 | 4.0 | 4.3 | 4.9 |
| 40 ~ 60                                      | 2.5                                                             | 2.6 | 3.0 | 3.1 | 3.1 | 3.2 | 3.4 | 3.7 | 3.7 | 4.1 | 4.5 | 5.2 |
| 60 ~ 80                                      | 2.6                                                             | 2.8 | 3.1 | 3.2 | 3.2 | 3.4 | 3.6 | 3.9 | 3.9 | 4.3 | 4.7 | 5.3 |
| 80 ~ 100                                     | 2.6                                                             | 2.8 | 3.2 | 3.3 | 3.3 | 3.5 | 3.7 | 4.0 | 4.1 | 4.4 | 4.8 | 5.5 |
| 100 ~ 120                                    | 2.7                                                             | 2.8 | 3.3 | 3.4 | 3.4 | 3.6 | 3.8 | 4.1 | 4.2 | 4.6 | 5.0 | 5.7 |
| 120 ~ 140                                    | 2.8                                                             | 3.0 | 3.4 | 3.5 | 3.5 | 3.7 | 3.9 | 4.2 | 4.3 | 4.7 | 5.1 | 5.8 |
| 140 ~ 160                                    | 2.8                                                             | 3.0 | 3.4 | 3.5 | 3.6 | 3.8 | 3.9 | 4.3 | 4.4 | 4.8 | 5.2 | 6.0 |
| 160 ~ 180                                    | 2.8                                                             | 3.0 | 3.4 | 3.5 | 3.6 | 3.9 | 4.1 | 4.5 | 4.5 | 5.0 | 5.4 | 6.2 |

## L-BSL 7

Code(d) 516641

Code(e) 518638

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.516 33<br>1.516 330 | Abbe Number $\nu_d$ | 64.06 | Dispersion $n_F - n_C$       | 0.008 060 |
| Refractive Index $n_e$ | 1.518 253             | Abbe Number $\nu_e$ | 63.87 | Dispersion $n_{F'} - n_{C'}$ | 0.008 114 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.488 10 |
| $n_{1970}$         | 1.970 09  | 1.494 04 |
| $n_{1530}$         | 1.529 58  | 1.500 20 |
| $n_{1129}$         | 1.128 64  | 1.505 23 |
| $n_t$              | 1.013 98  | 1.506 77 |
| $n_s$              | 0.852 11  | 1.509 30 |
| $n_{A'}$           | 0.768 19  | 1.510 94 |
| $n_F$              | 0.706 52  | 1.512 41 |
| $n_C$              | 0.656 27  | 1.513 85 |
| $n_{C'}$           | 0.643 85  | 1.514 24 |
| $n_{He-Ne}$        | 0.632 8   | 1.514 62 |
| $n_D$              | 0.589 29  | 1.516 26 |
| $n_d$              | 0.587 56  | 1.516 33 |
| $n_e$              | 0.546 07  | 1.518 25 |
| $n_F$              | 0.486 13  | 1.521 91 |
| $n_{F'}$           | 0.479 99  | 1.522 36 |
| $n_{He-Cd}$        | 0.441 57  | 1.525 64 |
| $n_g$              | 0.435 835 | 1.526 20 |
| $n_h$              | 0.404 656 | 1.529 75 |
| $n_i$              | 0.365 015 | 1.535 74 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.174 739 18E-01 |
| $A_2$                           | 3.526 876 65E-01 |
| $A_3$                           | 1.055 797 88E+00 |
| $B_1$                           | 5.277 014 11E-03 |
| $B_2$                           | 1.708 094 97E-02 |
| $B_3$                           | 1.043 025 83E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 2   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 3   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.2 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 79.3  |
| Rigidity Modulus G (GPa) | 32.7  |
| Poisson's Ratio $\sigma$ | 0.214 |
| Knoop Hardness Hk[Class] | 570   |
| Abrasion Aa              | 72    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.007 081 |
| $n_C - n_{A'}$      | 0.002 904 |
| $n_d - n_C$         | 0.002 484 |
| $n_e - n_C$         | 0.004 407 |
| $n_g - n_d$         | 0.009 874 |
| $n_g - n_F$         | 0.004 298 |
| $n_h - n_g$         | 0.003 544 |
| $n_i - n_g$         | 0.009 541 |
| $n_{C'} - n_t$      | 0.007 479 |
| $n_e - n_{C'}$      | 0.004 009 |
| $n_{F'} - n_e$      | 0.004 105 |
| $n_i - n_{F'}$      | 0.013 387 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.878 5 |
| $\theta_{C,A'}$              | 0.360 3 |
| $\theta_{d,C}$               | 0.308 2 |
| $\theta_{e,C}$               | 0.546 8 |
| $\theta_{g,d}$               | 1.225 1 |
| $\theta_{g,F}$               | 0.533 3 |
| $\theta_{h,g}$               | 0.439 7 |
| $\theta_{i,g}$               | 1.183 7 |
| $\theta'_{C,t}$              | 0.921 7 |
| $\theta'_{e,C'}$             | 0.494 1 |
| $\theta'_{F,e}$              | 0.505 9 |
| $\theta'_{i,F'}$             | 1.649 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.031 2  |
| $\Delta\theta_{C,A'}$ | 0.006 8  |
| $\Delta\theta_{g,d}$  | -0.006 6 |
| $\Delta\theta_{g,F}$  | -0.004 5 |
| $\Delta\theta_{i,g}$  | -0.004 9 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 330  | $\lambda_5$      | 295 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 326  | $\lambda_{0.05}$ | 299 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.08 | 0.09             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    | 0.08             |
| 310                    | 0.40             |
| 320                    | 0.71             |
| 330                    | 0.87             |
| 340                    | 0.942            |
| 350                    | 0.973            |
| 360                    | 0.986            |
| 370                    | 0.992            |
| 380                    | 0.994            |
| 390                    | 0.996            |
| 400                    | 0.997            |
| 420                    | 0.997            |
| 440                    | 0.997            |
| 460                    | 0.997            |
| 480                    | 0.998            |
| 500                    | 0.999            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.974            |
| 1 600                  | 0.994            |
| 1 800                  | 0.988            |
| 2 000                  | 0.974            |
| 2 200                  | 0.87             |
| 2 400                  | 0.80             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 464  |
| Annealing Point AP (°C)                                          | 488  |
| Transformation Temperature Tg (°C)                               | 497  |
| Yield Point At (°C)                                              | 560  |
| Softening Point SP (°C)                                          | 630  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 59   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 72   |
| Thermal Conductivity $\lambda$ (W/(mK))                          | 1.17 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 45                                             |
| -90 ~ -80                               | 46                                             |
| -80 ~ -70                               | 48                                             |
| -70 ~ -60                               | 49                                             |
| -60 ~ -50                               | 50                                             |
| -50 ~ -40                               | 52                                             |
| -40 ~ -30                               | 53                                             |
| -30 ~ -20                               | 54                                             |
| -20 ~ -10                               | 55                                             |
| -10 ~ 0                                 | 56                                             |
| 0 ~ 10                                  | 58                                             |
| 10 ~ 20                                 | 59                                             |
| 20 ~ 30                                 | 60                                             |
| 30 ~ 40                                 | 61                                             |
| 40 ~ 50                                 | 62                                             |
| 50 ~ 60                                 | 63                                             |
| 60 ~ 70                                 | 63                                             |
| 70 ~ 80                                 | 64                                             |
| 80 ~ 90                                 | 65                                             |
| 90 ~ 100                                | 66                                             |
| 100 ~ 110                               | 67                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 69                                             |
| 140 ~ 150                               | 69                                             |
| 150 ~ 160                               | 70                                             |
| 160 ~ 170                               | 70                                             |
| 170 ~ 180                               | 71                                             |
| 180 ~ 190                               | 71                                             |
| 190 ~ 200                               | 72                                             |
| 200 ~ 210                               | 72                                             |
| 210 ~ 220                               | 73                                             |
| 220 ~ 230                               | 73                                             |
| 230 ~ 240                               | 73                                             |
| 240 ~ 250                               | 73                                             |
| 250 ~ 260                               | 74                                             |
| 260 ~ 270                               | 74                                             |
| 270 ~ 280                               | 74                                             |
| 280 ~ 290                               | 74                                             |
| 290 ~ 300                               | 74                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.93 |
| Specific Gravity $d$                                     | 2.38 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 3.6                                                             | 3.7 | 3.8 | 3.9 | 3.9 | 3.9 | 4.1 | 4.3 | 4.3 | 4.5 | 4.7 | 5.1 |
| -60 ~ -40                                    | 3.4                                                             | 3.5 | 3.7 | 3.7 | 3.8 | 3.8 | 4.0 | 4.2 | 4.2 | 4.4 | 4.6 | 5.0 |
| -40 ~ -20                                    | 3.4                                                             | 3.5 | 3.7 | 3.7 | 3.8 | 3.9 | 4.0 | 4.2 | 4.2 | 4.4 | 4.6 | 5.0 |
| -20 ~ 0                                      | 3.4                                                             | 3.5 | 3.7 | 3.8 | 3.8 | 4.0 | 4.1 | 4.3 | 4.3 | 4.5 | 4.7 | 5.2 |
| 0 ~ 20                                       | 3.5                                                             | 3.7 | 3.8 | 3.9 | 3.9 | 4.0 | 4.1 | 4.3 | 4.3 | 4.6 | 4.9 | 5.4 |
| 20 ~ 40                                      | 3.6                                                             | 3.7 | 3.9 | 4.0 | 4.0 | 4.1 | 4.2 | 4.5 | 4.5 | 4.8 | 5.1 | 5.6 |
| 40 ~ 60                                      | 3.7                                                             | 3.8 | 4.1 | 4.2 | 4.2 | 4.3 | 4.4 | 4.7 | 4.7 | 5.0 | 5.2 | 5.7 |
| 60 ~ 80                                      | 3.8                                                             | 4.0 | 4.2 | 4.3 | 4.3 | 4.4 | 4.5 | 4.8 | 4.9 | 5.2 | 5.4 | 6.0 |
| 80 ~ 100                                     | 4.0                                                             | 4.1 | 4.3 | 4.4 | 4.4 | 4.6 | 4.7 | 4.9 | 5.0 | 5.2 | 5.5 | 6.2 |
| 100 ~ 120                                    | 4.1                                                             | 4.2 | 4.5 | 4.5 | 4.6 | 4.7 | 4.8 | 5.1 | 5.1 | 5.4 | 5.7 | 6.4 |
| 120 ~ 140                                    | 4.1                                                             | 4.3 | 4.5 | 4.6 | 4.6 | 4.9 | 4.9 | 5.3 | 5.3 | 5.6 | 5.9 | 6.5 |
| 140 ~ 160                                    | 4.3                                                             | 4.4 | 4.7 | 4.8 | 4.8 | 5.0 | 5.1 | 5.4 | 5.4 | 5.7 | 6.1 | 6.7 |
| 160 ~ 180                                    | 4.3                                                             | 4.5 | 4.8 | 4.9 | 4.9 | 5.0 | 5.2 | 5.5 | 5.5 | 5.8 | 6.2 | 6.8 |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.806 25<br>1.806 250 | Abbe Number $\nu_d$ | 40.91 | Dispersion $n_F - n_C$       | 0.019 709 |
| Refractive Index $n_e$ | 1.810 931             | Abbe Number $\nu_e$ | 40.66 | Dispersion $n_{F'} - n_{C'}$ | 0.019 946 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.760 94 |
| $n_{1970}$         | 1.970 09  | 1.767 97 |
| $n_{1530}$         | 1.529 58  | 1.775 69 |
| $n_{1129}$         | 1.128 64  | 1.783 03 |
| $n_t$              | 1.013 98  | 1.785 66 |
| $n_s$              | 0.852 11  | 1.790 48 |
| $n_{A'}$           | 0.768 19  | 1.793 91 |
| $n_F$              | 0.706 52  | 1.797 13 |
| $n_C$              | 0.656 27  | 1.800 39 |
| $n_{C'}$           | 0.643 85  | 1.801 32 |
| $n_{He-Ne}$        | 0.632 8   | 1.802 18 |
| $n_D$              | 0.589 29  | 1.806 08 |
| $n_d$              | 0.587 56  | 1.806 25 |
| $n_e$              | 0.546 07  | 1.810 93 |
| $n_F$              | 0.486 13  | 1.820 10 |
| $n_{F'}$           | 0.479 99  | 1.821 26 |
| $n_{He-Cd}$        | 0.441 57  | 1.829 81 |
| $n_g$              | 0.435 835 | 1.831 32 |
| $n_h$              | 0.404 656 | 1.840 90 |
| $n_i$              | 0.365 015 | 1.857 83 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.874 099 91E+00 |
| $A_2$                           | 2.979 214 02E-01 |
| $A_3$                           | 1.350 642 85E+00 |
| $B_1$                           | 9.933 183 44E-03 |
| $B_2$                           | 4.055 018 25E-02 |
| $B_3$                           | 1.005 022 00E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 115.1 |
| Rigidity Modulus G (GPa) | 44.3  |
| Poisson's Ratio $\sigma$ | 0.298 |
| Knoop Hardness Hk[Class] | 660 7 |
| Abrasion Aa              | 83    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.014 736 |
| $n_C - n_{A'}$      | 0.006 484 |
| $n_d - n_C$         | 0.005 856 |
| $n_e - n_C$         | 0.010 537 |
| $n_g - n_d$         | 0.025 070 |
| $n_g - n_F$         | 0.011 217 |
| $n_h - n_g$         | 0.009 578 |
| $n_i - n_g$         | 0.026 514 |
| $n_{C'} - n_t$      | 0.015 658 |
| $n_e - n_{C'}$      | 0.009 615 |
| $n_{F'} - n_e$      | 0.010 331 |
| $n_i - n_{F'}$      | 0.036 572 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.747 7 |
| $\theta_{C,A'}$              | 0.329 0 |
| $\theta_{d,C}$               | 0.297 1 |
| $\theta_{e,C}$               | 0.534 6 |
| $\theta_{g,d}$               | 1.272 0 |
| $\theta_{g,F}$               | 0.569 1 |
| $\theta_{h,g}$               | 0.486 0 |
| $\theta_{i,g}$               | 1.345 3 |
| $\theta'_{C,t}$              | 0.785 0 |
| $\theta'_{e,C'}$             | 0.482 1 |
| $\theta'_{F',e}$             | 0.517 9 |
| $\theta'_{i,F'}$             | 1.833 6 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.009 1  |
| $\Delta\theta_{C,A'}$ | 0.003 6  |
| $\Delta\theta_{g,d}$  | -0.007 7 |
| $\Delta\theta_{g,F}$  | -0.006 2 |
| $\Delta\theta_{i,g}$  | -0.037 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 400  | $\lambda_5$      | 335 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 367  | $\lambda_{0.05}$ | 338 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.88 | 0.94             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.16             |
| 350                    | 0.47             |
| 360                    | 0.70             |
| 370                    | 0.83             |
| 380                    | 0.89             |
| 390                    | 0.929            |
| 400                    | 0.950            |
| 420                    | 0.970            |
| 440                    | 0.979            |
| 460                    | 0.985            |
| 480                    | 0.989            |
| 500                    | 0.993            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.988            |
| 2 000                  | 0.969            |
| 2 200                  | 0.919            |
| 2 400                  | 0.73             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 534   |
| Annealing Point AP (°C)                                          | 558   |
| Transformation Temperature Tg (°C)                               | 573   |
| Yield Point At (°C)                                              | 610   |
| Softening Point SP (°C)                                          | 646   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 59    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 75    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.862 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 45                                             |
| -90 ~ -80                               | 46                                             |
| -80 ~ -70                               | 47                                             |
| -70 ~ -60                               | 49                                             |
| -60 ~ -50                               | 50                                             |
| -50 ~ -40                               | 51                                             |
| -40 ~ -30                               | 53                                             |
| -30 ~ -20                               | 54                                             |
| -20 ~ -10                               | 55                                             |
| -10 ~ 0                                 | 56                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 61                                             |
| 40 ~ 50                                 | 62                                             |
| 50 ~ 60                                 | 63                                             |
| 60 ~ 70                                 | 64                                             |
| 70 ~ 80                                 | 65                                             |
| 80 ~ 90                                 | 66                                             |
| 90 ~ 100                                | 67                                             |
| 100 ~ 110                               | 67                                             |
| 110 ~ 120                               | 68                                             |
| 120 ~ 130                               | 69                                             |
| 130 ~ 140                               | 70                                             |
| 140 ~ 150                               | 71                                             |
| 150 ~ 160                               | 72                                             |
| 160 ~ 170                               | 73                                             |
| 170 ~ 180                               | 73                                             |
| 180 ~ 190                               | 74                                             |
| 190 ~ 200                               | 75                                             |
| 200 ~ 210                               | 75                                             |
| 210 ~ 220                               | 76                                             |
| 220 ~ 230                               | 77                                             |
| 230 ~ 240                               | 77                                             |
| 240 ~ 250                               | 78                                             |
| 250 ~ 260                               | 78                                             |
| 260 ~ 270                               | 79                                             |
| 270 ~ 280                               | 80                                             |
| 280 ~ 290                               | 80                                             |
| 290 ~ 300                               | 80                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.88 |
| Specific Gravity $d$                                     | 4.49 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |      |      |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g    | h    | i    |
| -80 ~ -60                                    | 5.2                                                             | 5.5 | 6.0 | 6.2 | 6.2 | 6.5 | 6.7 | 7.4 | 7.4 | 8.1  | 8.9  | 10.3 |
| -60 ~ -40                                    | 5.1                                                             | 5.5 | 6.0 | 6.1 | 6.2 | 6.4 | 6.7 | 7.4 | 7.4 | 8.1  | 8.9  | 10.4 |
| -40 ~ -20                                    | 5.1                                                             | 5.4 | 5.9 | 6.1 | 6.2 | 6.5 | 6.8 | 7.4 | 7.5 | 8.2  | 9.0  | 10.6 |
| -20 ~ 0                                      | 5.2                                                             | 5.4 | 6.1 | 6.3 | 6.3 | 6.6 | 6.9 | 7.5 | 7.6 | 8.5  | 9.3  | 10.9 |
| 0 ~ 20                                       | 5.2                                                             | 5.6 | 6.2 | 6.4 | 6.4 | 6.8 | 7.1 | 7.7 | 7.8 | 8.7  | 9.5  | 11.2 |
| 20 ~ 40                                      | 5.4                                                             | 5.7 | 6.4 | 6.6 | 6.6 | 6.9 | 7.3 | 7.9 | 8.0 | 8.9  | 9.7  | 11.6 |
| 40 ~ 60                                      | 5.5                                                             | 5.9 | 6.5 | 6.7 | 6.7 | 7.1 | 7.4 | 8.1 | 8.2 | 9.1  | 10.0 | 11.9 |
| 60 ~ 80                                      | 5.6                                                             | 5.9 | 6.6 | 6.8 | 6.9 | 7.2 | 7.6 | 8.3 | 8.5 | 9.4  | 10.3 | 12.2 |
| 80 ~ 100                                     | 5.7                                                             | 6.1 | 6.7 | 6.9 | 7.0 | 7.4 | 7.7 | 8.5 | 8.6 | 9.5  | 10.5 | 12.5 |
| 100 ~ 120                                    | 5.8                                                             | 6.1 | 6.8 | 7.1 | 7.1 | 7.5 | 7.9 | 8.7 | 8.8 | 9.7  | 10.7 | 12.7 |
| 120 ~ 140                                    | 5.8                                                             | 6.2 | 6.9 | 7.1 | 7.2 | 7.6 | 8.0 | 8.8 | 8.9 | 9.9  | 10.9 | 13.0 |
| 140 ~ 160                                    | 5.8                                                             | 6.2 | 6.9 | 7.2 | 7.2 | 7.6 | 8.0 | 8.9 | 9.0 | 10.0 | 11.1 | 13.3 |
| 160 ~ 180                                    | 5.8                                                             | 6.2 | 6.9 | 7.2 | 7.2 | 7.6 | 8.1 | 8.9 | 9.1 | 10.2 | 11.3 | 13.5 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.808 35<br>1.808 350 | Abbe Number $\nu_d$ | 40.55 | Dispersion $n_F - n_C$       | 0.019 936 |
| Refractive Index $n_e$ | 1.813 086             | Abbe Number $\nu_e$ | 40.30 | Dispersion $n_{F'} - n_{C'}$ | 0.020 178 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.763 97 |
| $n_{1970}$         | 1.970 09  | 1.770 59 |
| $n_{1530}$         | 1.529 58  | 1.777 93 |
| $n_{1129}$         | 1.128 64  | 1.785 05 |
| $n_t$              | 1.013 98  | 1.787 65 |
| $n_s$              | 0.852 11  | 1.792 45 |
| $n_{A'}$           | 0.768 19  | 1.795 90 |
| $n_F$              | 0.706 52  | 1.799 14 |
| $n_C$              | 0.656 27  | 1.802 43 |
| $n_{C'}$           | 0.643 85  | 1.803 36 |
| $n_{He-Ne}$        | 0.632 8   | 1.804 24 |
| $n_D$              | 0.589 29  | 1.808 18 |
| $n_d$              | 0.587 56  | 1.808 35 |
| $n_e$              | 0.546 07  | 1.813 09 |
| $n_F$              | 0.486 13  | 1.822 37 |
| $n_{F'}$           | 0.479 99  | 1.823 54 |
| $n_{He-Cd}$        | 0.441 57  | 1.832 19 |
| $n_g$              | 0.435 835 | 1.833 72 |
| $n_h$              | 0.404 656 | 1.843 40 |
| $n_i$              | 0.365 015 | 1.860 48 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.836 061 27E+00 |
| $A_2$                           | 3.417 200 32E-01 |
| $A_3$                           | 1.352 801 73E+00 |
| $B_1$                           | 9.819 699 03E-03 |
| $B_2$                           | 3.856 362 64E-02 |
| $B_3$                           | 1.070 455 30E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 51.3 |
| Phosphate Resistance PR                   | 2.2  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 111.6 |
| Rigidity Modulus G (GPa) | 42.8  |
| Poisson's Ratio $\sigma$ | 0.303 |
| Knoop Hardness Hk[Class] | 640   |
| Abrasion Aa              | 88    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.014 785 |
| $n_C - n_{A'}$      | 0.006 535 |
| $n_d - n_C$         | 0.005 918 |
| $n_e - n_C$         | 0.010 654 |
| $n_g - n_d$         | 0.025 366 |
| $n_g - n_F$         | 0.011 348 |
| $n_h - n_g$         | 0.009 680 |
| $n_i - n_g$         | 0.026 762 |
| $n_{C'} - n_t$      | 0.015 716 |
| $n_e - n_{C'}$      | 0.009 723 |
| $n_{F'} - n_e$      | 0.010 455 |
| $n_i - n_{F'}$      | 0.036 937 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.741 6 |
| $\theta_{C,A'}$              | 0.327 8 |
| $\theta_{d,C}$               | 0.296 8 |
| $\theta_{e,C}$               | 0.534 4 |
| $\theta_{g,d}$               | 1.272 4 |
| $\theta_{g,F}$               | 0.569 2 |
| $\theta_{h,g}$               | 0.485 6 |
| $\theta_{i,g}$               | 1.342 4 |
| $\theta'_{C,t}$              | 0.778 9 |
| $\theta'_{e,C'}$             | 0.481 9 |
| $\theta'_{F,e}$              | 0.518 1 |
| $\theta'_{i,F'}$             | 1.830 6 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.004 7  |
| $\Delta\theta_{C,A'}$ | 0.002 8  |
| $\Delta\theta_{g,d}$  | -0.008 1 |
| $\Delta\theta_{g,F}$  | -0.006 7 |
| $\Delta\theta_{i,g}$  | -0.043 1 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 400  | $\lambda_5$      | 335 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 364  | $\lambda_{0.05}$ | 336 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.75 | 0.77             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.20             |
| 350                    | 0.54             |
| 360                    | 0.76             |
| 370                    | 0.87             |
| 380                    | 0.922            |
| 390                    | 0.950            |
| 400                    | 0.965            |
| 420                    | 0.979            |
| 440                    | 0.985            |
| 460                    | 0.990            |
| 480                    | 0.993            |
| 500                    | 0.996            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.997            |
| 1 800                  | 0.992            |
| 2 000                  | 0.975            |
| 2 200                  | 0.942            |
| 2 400                  | 0.79             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 491   |
| Annealing Point AP (°C)                                          | 515   |
| Transformation Temperature Tg (°C)                               | 531   |
| Yield Point At (°C)                                              | 577   |
| Softening Point SP (°C)                                          | 603   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 64    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 81    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.875 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 49                                             |
| -90 ~ -80                               | 51                                             |
| -80 ~ -70                               | 52                                             |
| -70 ~ -60                               | 53                                             |
| -60 ~ -50                               | 55                                             |
| -50 ~ -40                               | 56                                             |
| -40 ~ -30                               | 57                                             |
| -30 ~ -20                               | 58                                             |
| -20 ~ -10                               | 60                                             |
| -10 ~ 0                                 | 61                                             |
| 0 ~ 10                                  | 62                                             |
| 10 ~ 20                                 | 63                                             |
| 20 ~ 30                                 | 64                                             |
| 30 ~ 40                                 | 66                                             |
| 40 ~ 50                                 | 67                                             |
| 50 ~ 60                                 | 68                                             |
| 60 ~ 70                                 | 69                                             |
| 70 ~ 80                                 | 70                                             |
| 80 ~ 90                                 | 71                                             |
| 90 ~ 100                                | 72                                             |
| 100 ~ 110                               | 73                                             |
| 110 ~ 120                               | 74                                             |
| 120 ~ 130                               | 75                                             |
| 130 ~ 140                               | 76                                             |
| 140 ~ 150                               | 77                                             |
| 150 ~ 160                               | 78                                             |
| 160 ~ 170                               | 79                                             |
| 170 ~ 180                               | 80                                             |
| 180 ~ 190                               | 80                                             |
| 190 ~ 200                               | 81                                             |
| 200 ~ 210                               | 82                                             |
| 210 ~ 220                               | 83                                             |
| 220 ~ 230                               | 84                                             |
| 230 ~ 240                               | 84                                             |
| 240 ~ 250                               | 85                                             |
| 250 ~ 260                               | 86                                             |
| 260 ~ 270                               | 87                                             |
| 270 ~ 280                               | 87                                             |
| 280 ~ 290                               | 88                                             |
| 290 ~ 300                               | 89                                             |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 2.35 |
| Specific Gravity $d$                        | 4.62 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |      |      |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g    | h    | i    |
| -80 ~ -60                                    | 5.7                                                             | 6.0 | 6.6 | 6.7 | 6.8 | 7.1 | 7.3 | 8.0 | 8.1 | 8.8  | 9.7  | 11.2 |
| -60 ~ -40                                    | 5.7                                                             | 6.1 | 6.6 | 6.8 | 6.8 | 7.1 | 7.4 | 8.1 | 8.2 | 8.9  | 9.7  | 11.4 |
| -40 ~ -20                                    | 5.8                                                             | 6.1 | 6.6 | 6.8 | 6.9 | 7.3 | 7.6 | 8.2 | 8.3 | 9.0  | 10.0 | 11.6 |
| -20 ~ 0                                      | 5.8                                                             | 6.1 | 6.8 | 7.0 | 7.0 | 7.3 | 7.6 | 8.3 | 8.4 | 9.2  | 10.1 | 11.8 |
| 0 ~ 20                                       | 6.0                                                             | 6.3 | 6.9 | 7.1 | 7.2 | 7.5 | 7.8 | 8.5 | 8.6 | 9.5  | 10.4 | 12.1 |
| 20 ~ 40                                      | 6.0                                                             | 6.4 | 7.1 | 7.3 | 7.3 | 7.7 | 8.0 | 8.7 | 8.8 | 9.6  | 10.5 | 12.4 |
| 40 ~ 60                                      | 6.2                                                             | 6.5 | 7.2 | 7.4 | 7.4 | 7.8 | 8.1 | 8.8 | 8.9 | 9.8  | 10.7 | 12.7 |
| 60 ~ 80                                      | 6.2                                                             | 6.5 | 7.2 | 7.4 | 7.5 | 7.8 | 8.2 | 8.9 | 9.1 | 10.0 | 10.9 | 12.9 |
| 80 ~ 100                                     | 6.3                                                             | 6.6 | 7.3 | 7.5 | 7.5 | 7.9 | 8.2 | 9.0 | 9.1 | 10.0 | 11.0 | 13.1 |
| 100 ~ 120                                    | 6.2                                                             | 6.6 | 7.2 | 7.5 | 7.5 | 7.9 | 8.3 | 9.0 | 9.2 | 10.1 | 11.1 | 13.1 |
| 120 ~ 140                                    | 6.1                                                             | 6.5 | 7.2 | 7.4 | 7.5 | 7.9 | 8.2 | 9.0 | 9.1 | 10.1 | 11.1 | 13.2 |
| 140 ~ 160                                    | 6.0                                                             | 6.4 | 7.1 | 7.3 | 7.4 | 7.8 | 8.1 | 9.0 | 9.1 | 10.1 | 11.1 | 13.3 |
| 160 ~ 180                                    | 5.8                                                             | 6.1 | 6.9 | 7.1 | 7.2 | 7.6 | 8.0 | 8.8 | 9.0 | 10.0 | 11.1 | 13.2 |

L-LAH85V

Code(d) 854404  
Code(e) 859401

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.854 00<br>1.854 000 | Abbe Number $\nu_d$ | 40.38 | Dispersion $n_F - n_C$       | 0.021 151 |
| Refractive Index $n_e$ | 1.859 025             | Abbe Number $\nu_e$ | 40.13 | Dispersion $n_{F'} - n_{C'}$ | 0.021 407 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.807 40 |
| $n_{1970}$         | 1.970 09  | 1.814 25 |
| $n_{1530}$         | 1.529 58  | 1.821 88 |
| $n_{1129}$         | 1.128 64  | 1.829 34 |
| $n_t$              | 1.013 98  | 1.832 07 |
| $n_s$              | 0.852 11  | 1.837 14 |
| $n_{A'}$           | 0.768 19  | 1.840 79 |
| $n_F$              | 0.706 52  | 1.844 23 |
| $n_C$              | 0.656 27  | 1.847 72 |
| $n_{C'}$           | 0.643 85  | 1.848 71 |
| $n_{He-Ne}$        | 0.632 8   | 1.849 64 |
| $n_D$              | 0.589 29  | 1.853 81 |
| $n_d$              | 0.587 56  | 1.854 00 |
| $n_e$              | 0.546 07  | 1.859 03 |
| $n_F$              | 0.486 13  | 1.868 87 |
| $n_{F'}$           | 0.479 99  | 1.870 12 |
| $n_{He-Cd}$        | 0.441 57  | 1.879 29 |
| $n_g$              | 0.435 835 | 1.880 90 |
| $n_h$              | 0.404 656 | 1.891 16 |
| $n_i$              | 0.365 015 | 1.909 23 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.974 605 03E+00 |
| $A_2$                           | 3.619 035 92E-01 |
| $A_3$                           | 1.384 332 41E+00 |
| $B_1$                           | 1.018 542 58E-02 |
| $B_2$                           | 3.848 291 18E-02 |
| $B_3$                           | 1.037 136 27E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 4   |
| Acid Resistance(Surface) Group SR         | 3.2 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 111.5 |
| Rigidity Modulus G (GPa) | 42.7  |
| Poisson's Ratio $\sigma$ | 0.306 |
| Knoop Hardness Hk[Class] | 670 7 |
| Abrasion Aa              | 65    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.015 652 |
| $n_C - n_{A'}$      | 0.006 929 |
| $n_d - n_C$         | 0.006 279 |
| $n_e - n_C$         | 0.011 304 |
| $n_g - n_d$         | 0.026 903 |
| $n_g - n_F$         | 0.012 031 |
| $n_h - n_g$         | 0.010 254 |
| $n_i - n_g$         | 0.028 327 |
| $n_{C'} - n_t$      | 0.016 640 |
| $n_e - n_{C'}$      | 0.010 316 |
| $n_{F'} - n_e$      | 0.011 091 |
| $n_i - n_{F'}$      | 0.039 114 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.740 0 |
| $\theta_{C,A'}$              | 0.327 6 |
| $\theta_{d,C}$               | 0.296 9 |
| $\theta_{e,C}$               | 0.534 4 |
| $\theta_{g,d}$               | 1.271 9 |
| $\theta_{g,F}$               | 0.568 8 |
| $\theta_{h,g}$               | 0.484 8 |
| $\theta_{i,g}$               | 1.339 3 |
| $\theta'_{C,t}$              | 0.777 3 |
| $\theta'_{e,C'}$             | 0.481 9 |
| $\theta'_{F',e}$             | 0.518 1 |
| $\theta'_{i,F'}$             | 1.827 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.003 9  |
| $\Delta\theta_{C,A'}$ | 0.002 8  |
| $\Delta\theta_{g,d}$  | -0.008 9 |
| $\Delta\theta_{g,F}$  | -0.007 3 |
| $\Delta\theta_{i,g}$  | -0.047 6 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 340 |
| $\lambda_{70}$        | 380  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 373  | $\lambda_{0.05}$ | 340 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.17 | 1.20             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.05             |
| 350                    | 0.30             |
| 360                    | 0.58             |
| 370                    | 0.77             |
| 380                    | 0.86             |
| 390                    | 0.915            |
| 400                    | 0.944            |
| 420                    | 0.971            |
| 440                    | 0.981            |
| 460                    | 0.987            |
| 480                    | 0.992            |
| 500                    | 0.995            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.998            |
| 1 800                  | 0.992            |
| 2 000                  | 0.973            |
| 2 200                  | 0.933            |
| 2 400                  | 0.77             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 616   |
| Yield Point At (°C)                                              | 658   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 65    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 77    |
| Thermal Conductivity $\lambda$ (W/(mK))                          | 0.819 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 54                                             |
| -90 ~ -80                               | 55                                             |
| -80 ~ -70                               | 55                                             |
| -70 ~ -60                               | 56                                             |
| -60 ~ -50                               | 57                                             |
| -50 ~ -40                               | 58                                             |
| -40 ~ -30                               | 59                                             |
| -30 ~ -20                               | 60                                             |
| -20 ~ -10                               | 61                                             |
| -10 ~ 0                                 | 62                                             |
| 0 ~ 10                                  | 63                                             |
| 10 ~ 20                                 | 63                                             |
| 20 ~ 30                                 | 64                                             |
| 30 ~ 40                                 | 65                                             |
| 40 ~ 50                                 | 66                                             |
| 50 ~ 60                                 | 67                                             |
| 60 ~ 70                                 | 67                                             |
| 70 ~ 80                                 | 68                                             |
| 80 ~ 90                                 | 69                                             |
| 90 ~ 100                                | 70                                             |
| 100 ~ 110                               | 70                                             |
| 110 ~ 120                               | 71                                             |
| 120 ~ 130                               | 72                                             |
| 130 ~ 140                               | 73                                             |
| 140 ~ 150                               | 73                                             |
| 150 ~ 160                               | 74                                             |
| 160 ~ 170                               | 75                                             |
| 170 ~ 180                               | 75                                             |
| 180 ~ 190                               | 76                                             |
| 190 ~ 200                               | 77                                             |
| 200 ~ 210                               | 77                                             |
| 210 ~ 220                               | 78                                             |
| 220 ~ 230                               | 79                                             |
| 230 ~ 240                               | 79                                             |
| 240 ~ 250                               | 80                                             |
| 250 ~ 260                               | 81                                             |
| 260 ~ 270                               | 81                                             |
| 270 ~ 280                               | 82                                             |
| 280 ~ 290                               | 82                                             |
| 290 ~ 300                               | 83                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.83 |
| Specific Gravity $d$                                     | 5.25 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |      |      |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g    | h    | i    |
| -80 ~ -60                                    | 4.8                                                             | 5.1 | 5.6 | 5.8 | 5.8 | 6.1 | 6.3 | 7.0 | 7.1 | 7.7  | 8.5  | 9.9  |
| -60 ~ -40                                    | 4.6                                                             | 4.9 | 5.5 | 5.6 | 5.7 | 6.0 | 6.2 | 6.8 | 6.9 | 7.7  | 8.4  | 10.0 |
| -40 ~ -20                                    | 4.5                                                             | 4.9 | 5.4 | 5.6 | 5.6 | 5.9 | 6.2 | 6.9 | 7.0 | 7.7  | 8.5  | 10.2 |
| -20 ~ 0                                      | 4.6                                                             | 4.9 | 5.4 | 5.6 | 5.7 | 6.1 | 6.4 | 7.0 | 7.1 | 7.9  | 8.7  | 10.4 |
| 0 ~ 20                                       | 4.6                                                             | 4.9 | 5.5 | 5.7 | 5.7 | 6.2 | 6.5 | 7.2 | 7.2 | 8.1  | 8.9  | 10.8 |
| 20 ~ 40                                      | 4.7                                                             | 5.0 | 5.6 | 5.8 | 5.9 | 6.2 | 6.6 | 7.3 | 7.4 | 8.3  | 9.2  | 11.1 |
| 40 ~ 60                                      | 4.8                                                             | 5.1 | 5.8 | 6.0 | 6.0 | 6.4 | 6.7 | 7.5 | 7.6 | 8.6  | 9.5  | 11.4 |
| 60 ~ 80                                      | 4.9                                                             | 5.2 | 6.0 | 6.2 | 6.2 | 6.6 | 7.0 | 7.8 | 7.9 | 8.8  | 9.8  | 11.8 |
| 80 ~ 100                                     | 5.0                                                             | 5.4 | 6.1 | 6.3 | 6.4 | 6.7 | 7.1 | 8.0 | 8.0 | 9.1  | 10.1 | 12.2 |
| 100 ~ 120                                    | 5.1                                                             | 5.5 | 6.2 | 6.4 | 6.5 | 6.9 | 7.3 | 8.1 | 8.3 | 9.3  | 10.5 | 12.6 |
| 120 ~ 140                                    | 5.2                                                             | 5.6 | 6.3 | 6.6 | 6.7 | 7.1 | 7.5 | 8.3 | 8.5 | 9.5  | 10.6 | 13.0 |
| 140 ~ 160                                    | 5.2                                                             | 5.6 | 6.4 | 6.7 | 6.8 | 7.2 | 7.6 | 8.6 | 8.6 | 9.8  | 11.0 | 13.3 |
| 160 ~ 180                                    | 5.3                                                             | 5.7 | 6.5 | 6.9 | 7.0 | 7.4 | 7.8 | 8.8 | 8.9 | 10.0 | 11.2 | 13.6 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.832 20<br>1.832 200 | Abbe Number $\nu_d$ | 40.10 | Dispersion $n_F - n_C$       | 0.020 755 |
| Refractive Index $n_e$ | 1.837 128             | Abbe Number $\nu_e$ | 39.84 | Dispersion $n_{F'} - n_{C'}$ | 0.021 011 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.786 02 |
| $n_{1970}$         | 1.970 09  | 1.792 93 |
| $n_{1530}$         | 1.529 58  | 1.800 58 |
| $n_{1129}$         | 1.128 64  | 1.808 00 |
| $n_t$              | 1.013 98  | 1.810 69 |
| $n_s$              | 0.852 11  | 1.815 68 |
| $n_{A'}$           | 0.768 19  | 1.819 26 |
| $n_F$              | 0.706 52  | 1.822 62 |
| $n_C$              | 0.656 27  | 1.826 05 |
| $n_{C'}$           | 0.643 85  | 1.827 01 |
| $n_{He-Ne}$        | 0.632 8   | 1.827 92 |
| $n_D$              | 0.589 29  | 1.832 02 |
| $n_d$              | 0.587 56  | 1.832 20 |
| $n_e$              | 0.546 07  | 1.837 13 |
| $n_F$              | 0.486 13  | 1.846 80 |
| $n_{F'}$           | 0.479 99  | 1.848 03 |
| $n_{He-Cd}$        | 0.441 57  | 1.857 07 |
| $n_g$              | 0.435 835 | 1.858 66 |
| $n_h$              | 0.404 656 | 1.868 81 |
| $n_i$              | 0.365 015 | 1.886 83 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.975 953 01E+00 |
| $A_2$                           | 2.839 249 85E-01 |
| $A_3$                           | 1.351 763 68E+00 |
| $B_1$                           | 1.042 763 95E-02 |
| $B_2$                           | 4.277 082 22E-02 |
| $B_3$                           | 1.014 537 10E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 5,2 |
| Phosphate Resistance PR                   | 1,2 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 114.8 |
| Rigidity Modulus G (GPa) | 44.0  |
| Poisson's Ratio $\sigma$ | 0.304 |
| Knoop Hardness Hk[Class] | 660 7 |
| Abrasion Aa              | 80    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.015 354 |
| $n_C - n_{A'}$      | 0.006 789 |
| $n_d - n_C$         | 0.006 153 |
| $n_e - n_C$         | 0.011 081 |
| $n_g - n_d$         | 0.026 462 |
| $n_g - n_F$         | 0.011 860 |
| $n_h - n_g$         | 0.010 152 |
| $n_i - n_g$         | 0.028 165 |
| $n_{C'} - n_t$      | 0.016 322 |
| $n_e - n_{C'}$      | 0.010 113 |
| $n_{F'} - n_e$      | 0.010 898 |
| $n_i - n_{F'}$      | 0.038 801 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.739 8 |
| $\theta_{C,A'}$              | 0.327 1 |
| $\theta_{d,C}$               | 0.296 5 |
| $\theta_{e,C}$               | 0.533 9 |
| $\theta_{g,d}$               | 1.275 0 |
| $\theta_{g,F}$               | 0.571 4 |
| $\theta_{h,g}$               | 0.489 1 |
| $\theta_{i,g}$               | 1.357 0 |
| $\theta'_{C,t}$              | 0.776 8 |
| $\theta'_{e,C'}$             | 0.481 3 |
| $\theta'_{F',e}$             | 0.518 7 |
| $\theta'_{i,F'}$             | 1.846 7 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.005 0  |
| $\Delta\theta_{C,A'}$ | 0.002 6  |
| $\Delta\theta_{g,d}$  | -0.006 4 |
| $\Delta\theta_{g,F}$  | -0.005 2 |
| $\Delta\theta_{i,g}$  | -0.032 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 410  | $\lambda_5$      | 340 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 376  | $\lambda_{0.05}$ | 340 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.32 | 1.36             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.05             |
| 350                    | 0.26             |
| 360                    | 0.55             |
| 370                    | 0.73             |
| 380                    | 0.84             |
| 390                    | 0.903            |
| 400                    | 0.936            |
| 420                    | 0.966            |
| 440                    | 0.978            |
| 460                    | 0.985            |
| 480                    | 0.990            |
| 500                    | 0.994            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.996            |
| 1 600                  | 0.994            |
| 1 800                  | 0.988            |
| 2 000                  | 0.969            |
| 2 200                  | 0.925            |
| 2 400                  | 0.75             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 578   |
| Annealing Point AP (°C)                                          | 597   |
| Transformation Temperature Tg (°C)                               | 615   |
| Yield Point At (°C)                                              | 654   |
| Softening Point SP (°C)                                          | 677   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 62    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 76    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.839 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 49                                             |
| -90 ~ -80                               | 50                                             |
| -80 ~ -70                               | 52                                             |
| -70 ~ -60                               | 53                                             |
| -60 ~ -50                               | 54                                             |
| -50 ~ -40                               | 55                                             |
| -40 ~ -30                               | 56                                             |
| -30 ~ -20                               | 57                                             |
| -20 ~ -10                               | 58                                             |
| -10 ~ 0                                 | 59                                             |
| 0 ~ 10                                  | 60                                             |
| 10 ~ 20                                 | 61                                             |
| 20 ~ 30                                 | 62                                             |
| 30 ~ 40                                 | 63                                             |
| 40 ~ 50                                 | 64                                             |
| 50 ~ 60                                 | 65                                             |
| 60 ~ 70                                 | 66                                             |
| 70 ~ 80                                 | 67                                             |
| 80 ~ 90                                 | 68                                             |
| 90 ~ 100                                | 69                                             |
| 100 ~ 110                               | 69                                             |
| 110 ~ 120                               | 70                                             |
| 120 ~ 130                               | 71                                             |
| 130 ~ 140                               | 72                                             |
| 140 ~ 150                               | 73                                             |
| 150 ~ 160                               | 73                                             |
| 160 ~ 170                               | 74                                             |
| 170 ~ 180                               | 75                                             |
| 180 ~ 190                               | 75                                             |
| 190 ~ 200                               | 76                                             |
| 200 ~ 210                               | 76                                             |
| 210 ~ 220                               | 77                                             |
| 220 ~ 230                               | 78                                             |
| 230 ~ 240                               | 78                                             |
| 240 ~ 250                               | 79                                             |
| 250 ~ 260                               | 79                                             |
| 260 ~ 270                               | 80                                             |
| 270 ~ 280                               | 80                                             |
| 280 ~ 290                               | 81                                             |
| 290 ~ 300                               | 81                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.93 |
| Specific Gravity $d$                                      | 4.65 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |      |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |      |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i    |
| -80 ~ -60                                    | 4.0                                                             | 4.2 | 4.7 | 4.9 | 4.9 | 5.3 | 5.6 | 6.2 | 6.3 | 7.1 | 7.9  | 9.6  |
| -60 ~ -40                                    | 3.9                                                             | 4.2 | 4.7 | 4.9 | 4.9 | 5.3 | 5.6 | 6.2 | 6.3 | 7.1 | 8.0  | 9.7  |
| -40 ~ -20                                    | 4.0                                                             | 4.2 | 4.9 | 5.1 | 5.1 | 5.4 | 5.7 | 6.4 | 6.4 | 7.3 | 8.2  | 9.9  |
| -20 ~ 0                                      | 4.1                                                             | 4.4 | 5.0 | 5.2 | 5.2 | 5.5 | 5.9 | 6.6 | 6.7 | 7.5 | 8.4  | 10.3 |
| 0 ~ 20                                       | 4.2                                                             | 4.5 | 5.1 | 5.3 | 5.4 | 5.7 | 6.0 | 6.8 | 6.9 | 7.8 | 8.7  | 10.5 |
| 20 ~ 40                                      | 4.3                                                             | 4.7 | 5.3 | 5.5 | 5.6 | 5.9 | 6.3 | 7.0 | 7.1 | 8.0 | 9.0  | 10.9 |
| 40 ~ 60                                      | 4.5                                                             | 4.9 | 5.5 | 5.7 | 5.8 | 6.1 | 6.4 | 7.2 | 7.3 | 8.2 | 9.2  | 11.2 |
| 60 ~ 80                                      | 4.6                                                             | 5.0 | 5.6 | 5.8 | 5.9 | 6.4 | 6.7 | 7.5 | 7.6 | 8.5 | 9.5  | 11.5 |
| 80 ~ 100                                     | 4.8                                                             | 5.1 | 5.8 | 6.0 | 6.0 | 6.4 | 6.8 | 7.6 | 7.7 | 8.7 | 9.7  | 11.8 |
| 100 ~ 120                                    | 4.8                                                             | 5.2 | 5.9 | 6.1 | 6.2 | 6.5 | 6.9 | 7.7 | 7.8 | 8.8 | 9.8  | 12.0 |
| 120 ~ 140                                    | 4.9                                                             | 5.2 | 5.9 | 6.2 | 6.2 | 6.6 | 7.0 | 7.8 | 7.9 | 8.9 | 10.0 | 12.2 |
| 140 ~ 160                                    | 4.9                                                             | 5.2 | 6.0 | 6.2 | 6.3 | 6.7 | 7.0 | 7.9 | 8.0 | 9.0 | 10.2 | 12.4 |
| 160 ~ 180                                    | 4.8                                                             | 5.2 | 5.9 | 6.3 | 6.3 | 6.7 | 7.2 | 8.0 | 8.1 | 9.2 | 10.3 | 12.5 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.764 50<br>1.764 500 | Abbe Number $\nu_d$ | 49.09 | Dispersion $n_F - n_C$       | 0.015 572 |
| Refractive Index $n_e$ | 1.768 208             | Abbe Number $\nu_e$ | 48.85 | Dispersion $n_{F'} - n_{C'}$ | 0.015 726 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.724 04 |
| $n_{1970}$         | 1.970 09  | 1.731 03 |
| $n_{1530}$         | 1.529 58  | 1.738 52 |
| $n_{1129}$         | 1.128 64  | 1.745 27 |
| $n_t$              | 1.013 98  | 1.747 58 |
| $n_s$              | 0.852 11  | 1.751 68 |
| $n_{A'}$           | 0.768 19  | 1.754 53 |
| $n_F$              | 0.706 52  | 1.757 16 |
| $n_C$              | 0.656 27  | 1.759 81 |
| $n_{C'}$           | 0.643 85  | 1.760 55 |
| $n_{He-Ne}$        | 0.632 8   | 1.761 25 |
| $n_D$              | 0.589 29  | 1.764 36 |
| $n_d$              | 0.587 56  | 1.764 50 |
| $n_e$              | 0.546 07  | 1.768 21 |
| $n_F$              | 0.486 13  | 1.775 38 |
| $n_{F'}$           | 0.479 99  | 1.776 28 |
| $n_{He-Cd}$        | 0.441 57  | 1.782 84 |
| $n_g$              | 0.435 835 | 1.783 99 |
| $n_h$              | 0.404 656 | 1.791 20 |
| $n_i$              | 0.365 015 | 1.803 60 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.261 441 28E+00 |
| $A_2$                           | 7.821 152 73E-01 |
| $A_3$                           | 1.158 236 45E+00 |
| $B_1$                           | 5.725 125 82E-03 |
| $B_2$                           | 2.198 297 52E-02 |
| $B_3$                           | 8.804 822 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 114.4 |
| Rigidity Modulus G (GPa) | 43.9  |
| Poisson's Ratio $\sigma$ | 0.301 |
| Knoop Hardness Hk[Class] | 680 7 |
| Abrasion Aa              | 68    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.012 232 |
| $n_C - n_{A'}$      | 0.005 282 |
| $n_d - n_C$         | 0.004 692 |
| $n_e - n_C$         | 0.008 400 |
| $n_g - n_d$         | 0.019 488 |
| $n_g - n_F$         | 0.008 608 |
| $n_h - n_g$         | 0.007 208 |
| $n_i - n_g$         | 0.019 614 |
| $n_{C'} - n_t$      | 0.012 975 |
| $n_e - n_{C'}$      | 0.007 657 |
| $n_{F'} - n_e$      | 0.008 069 |
| $n_i - n_{F'}$      | 0.027 325 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.785 5 |
| $\theta_{C,A'}$              | 0.339 2 |
| $\theta_{d,C}$               | 0.301 3 |
| $\theta_{e,C}$               | 0.539 4 |
| $\theta_{g,d}$               | 1.251 5 |
| $\theta_{g,F}$               | 0.552 8 |
| $\theta_{h,g}$               | 0.462 9 |
| $\theta_{i,g}$               | 1.259 6 |
| $\theta'_{C,t}$              | 0.825 1 |
| $\theta'_{e,C'}$             | 0.486 9 |
| $\theta'_{F',e}$             | 0.513 1 |
| $\theta'_{i,F'}$             | 1.737 6 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.008 5  |
| $\Delta\theta_{C,A'}$ | 0.003 8  |
| $\Delta\theta_{g,d}$  | -0.011 3 |
| $\Delta\theta_{g,F}$  | -0.009 2 |
| $\Delta\theta_{i,g}$  | -0.054 4 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 365  | $\lambda_5$      | 275 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 333  | $\lambda_{0.05}$ | 274 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.30 | 0.31             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.15             |
| 290                    | 0.32             |
| 300                    | 0.46             |
| 310                    | 0.59             |
| 320                    | 0.69             |
| 330                    | 0.78             |
| 340                    | 0.85             |
| 350                    | 0.902            |
| 360                    | 0.937            |
| 370                    | 0.954            |
| 380                    | 0.973            |
| 390                    | 0.981            |
| 400                    | 0.986            |
| 420                    | 0.991            |
| 440                    | 0.993            |
| 460                    | 0.996            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.988            |
| 2 000                  | 0.963            |
| 2 200                  | 0.905            |
| 2 400                  | 0.67             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 578   |
| Annealing Point AP (°C)                                          | 599   |
| Transformation Temperature Tg (°C)                               | 620   |
| Yield Point At (°C)                                              | 650   |
| Softening Point SP (°C)                                          | 676   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 59    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 73    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.841 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 45                                             |
| -90 ~ -80                               | 47                                             |
| -80 ~ -70                               | 48                                             |
| -70 ~ -60                               | 49                                             |
| -60 ~ -50                               | 50                                             |
| -50 ~ -40                               | 52                                             |
| -40 ~ -30                               | 53                                             |
| -30 ~ -20                               | 54                                             |
| -20 ~ -10                               | 55                                             |
| -10 ~ 0                                 | 56                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 60                                             |
| 40 ~ 50                                 | 61                                             |
| 50 ~ 60                                 | 62                                             |
| 60 ~ 70                                 | 63                                             |
| 70 ~ 80                                 | 64                                             |
| 80 ~ 90                                 | 65                                             |
| 90 ~ 100                                | 66                                             |
| 100 ~ 110                               | 67                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 69                                             |
| 140 ~ 150                               | 70                                             |
| 150 ~ 160                               | 70                                             |
| 160 ~ 170                               | 71                                             |
| 170 ~ 180                               | 72                                             |
| 180 ~ 190                               | 72                                             |
| 190 ~ 200                               | 73                                             |
| 200 ~ 210                               | 74                                             |
| 210 ~ 220                               | 74                                             |
| 220 ~ 230                               | 75                                             |
| 230 ~ 240                               | 75                                             |
| 240 ~ 250                               | 76                                             |
| 250 ~ 260                               | 76                                             |
| 260 ~ 270                               | 77                                             |
| 270 ~ 280                               | 77                                             |
| 280 ~ 290                               | 78                                             |
| 290 ~ 300                               | 78                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.71 |
| Specific Gravity $d$                                     | 4.29 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 4.2                                                             | 4.5 | 5.0 | 5.1 | 5.2 | 5.4 | 5.8 | 6.2 | 6.3 | 6.9 | 7.5 | 8.5  |
| -60 ~ -40                                    | 4.4                                                             | 4.6 | 5.1 | 5.3 | 5.3 | 5.5 | 5.9 | 6.4 | 6.4 | 7.0 | 7.5 | 8.7  |
| -40 ~ -20                                    | 4.5                                                             | 4.9 | 5.4 | 5.5 | 5.5 | 5.8 | 6.0 | 6.5 | 6.6 | 7.3 | 7.8 | 8.9  |
| -20 ~ 0                                      | 4.8                                                             | 5.0 | 5.5 | 5.7 | 5.7 | 6.0 | 6.3 | 6.8 | 6.9 | 7.5 | 8.1 | 9.2  |
| 0 ~ 20                                       | 5.0                                                             | 5.2 | 5.7 | 6.0 | 6.1 | 6.3 | 6.6 | 7.1 | 7.1 | 7.7 | 8.3 | 9.4  |
| 20 ~ 40                                      | 5.2                                                             | 5.5 | 6.0 | 6.2 | 6.2 | 6.5 | 6.7 | 7.3 | 7.4 | 8.0 | 8.6 | 9.7  |
| 40 ~ 60                                      | 5.4                                                             | 5.7 | 6.2 | 6.5 | 6.5 | 6.8 | 7.0 | 7.6 | 7.6 | 8.2 | 8.8 | 9.9  |
| 60 ~ 80                                      | 5.6                                                             | 5.9 | 6.4 | 6.5 | 6.6 | 6.9 | 7.1 | 7.6 | 7.7 | 8.3 | 8.9 | 10.1 |
| 80 ~ 100                                     | 5.7                                                             | 6.1 | 6.6 | 6.8 | 6.8 | 7.1 | 7.3 | 7.9 | 8.0 | 8.6 | 9.2 | 10.3 |
| 100 ~ 120                                    | 5.7                                                             | 6.0 | 6.6 | 6.8 | 6.9 | 7.1 | 7.4 | 7.9 | 8.0 | 8.6 | 9.2 | 10.3 |
| 120 ~ 140                                    | 5.7                                                             | 6.0 | 6.6 | 6.8 | 6.9 | 7.1 | 7.4 | 7.9 | 8.0 | 8.6 | 9.2 | 10.3 |
| 140 ~ 160                                    | 5.9                                                             | 6.1 | 6.7 | 6.9 | 6.9 | 7.2 | 7.4 | 8.0 | 8.1 | 8.7 | 9.3 | 10.4 |
| 160 ~ 180                                    | 5.7                                                             | 6.0 | 6.6 | 6.7 | 6.8 | 7.1 | 7.3 | 7.9 | 7.9 | 8.6 | 9.2 | 10.3 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.861 00<br>1.861 000 | Abbe Number $\nu_d$ | 37.10 | Dispersion $n_F - n_C$       | 0.023 209 |
| Refractive Index $n_e$ | 1.866 504             | Abbe Number $\nu_e$ | 36.85 | Dispersion $n_{F'} - n_{C'}$ | 0.023 517 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.812 15 |
| $n_{1970}$         | 1.970 09  | 1.819 04 |
| $n_{1530}$         | 1.529 58  | 1.826 77 |
| $n_{1129}$         | 1.128 64  | 1.834 49 |
| $n_t$              | 1.013 98  | 1.837 36 |
| $n_s$              | 0.852 11  | 1.842 76 |
| $n_{A'}$           | 0.768 19  | 1.846 67 |
| $n_F$              | 0.706 52  | 1.850 38 |
| $n_C$              | 0.656 27  | 1.854 16 |
| $n_{C'}$           | 0.643 85  | 1.855 23 |
| $n_{He-Ne}$        | 0.632 8   | 1.856 24 |
| $n_D$              | 0.589 29  | 1.860 80 |
| $n_d$              | 0.587 56  | 1.861 00 |
| $n_e$              | 0.546 07  | 1.866 50 |
| $n_F$              | 0.486 13  | 1.877 37 |
| $n_{F'}$           | 0.479 99  | 1.878 75 |
| $n_{He-Cd}$        | 0.441 57  | 1.888 99 |
| $n_g$              | 0.435 835 | 1.890 80 |
| $n_h$              | 0.404 656 | 1.902 38 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.006 214 20E+00 |
| $A_2$                           | 3.470 298 88E-01 |
| $A_3$                           | 1.416 883 82E+00 |
| $B_1$                           | 1.054 992 38E-02 |
| $B_2$                           | 4.458 450 13E-02 |
| $B_3$                           | 1.059 952 50E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 112.1 |
| Rigidity Modulus G (GPa) | 43.0  |
| Poisson's Ratio $\sigma$ | 0.305 |
| Knoop Hardness Hk[Class] | 650 7 |
| Abrasion Aa              | 81    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.016 800 |
| $n_C - n_{A'}$      | 0.007 490 |
| $n_d - n_C$         | 0.006 839 |
| $n_e - n_C$         | 0.012 343 |
| $n_g - n_d$         | 0.029 797 |
| $n_g - n_F$         | 0.013 427 |
| $n_h - n_g$         | 0.011 584 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.017 873 |
| $n_e - n_{C'}$      | 0.011 270 |
| $n_{F'} - n_e$      | 0.012 247 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.723 9 |
| $\theta_{C,A'}$              | 0.322 7 |
| $\theta_{d,C}$               | 0.294 7 |
| $\theta_{e,C}$               | 0.531 8 |
| $\theta_{g,d}$               | 1.283 9 |
| $\theta_{g,F}$               | 0.578 5 |
| $\theta_{h,g}$               | 0.499 1 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.760 0 |
| $\theta'_{e,C'}$             | 0.479 2 |
| $\theta'_{F',e}$             | 0.520 8 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.003 2  |
| $\Delta\theta_{C,A'}$ | 0.001 9  |
| $\Delta\theta_{g,d}$  | -0.003 8 |
| $\Delta\theta_{g,F}$  | -0.002 9 |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 350 |
| $\lambda_{70}$        | 390  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 385  | $\lambda_{0.05}$ | 349 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.80 | 1.88             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.06             |
| 360                    | 0.31             |
| 370                    | 0.58             |
| 380                    | 0.75             |
| 390                    | 0.85             |
| 400                    | 0.908            |
| 420                    | 0.957            |
| 440                    | 0.975            |
| 460                    | 0.983            |
| 480                    | 0.989            |
| 500                    | 0.993            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.989            |
| 2 000                  | 0.970            |
| 2 200                  | 0.923            |
| 2 400                  | 0.74             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 560   |
| Annealing Point AP (°C)                                          | 583   |
| Transformation Temperature Tg (°C)                               | 595   |
| Yield Point At (°C)                                              | 635   |
| Softening Point SP (°C)                                          | 664   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 66    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 81    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.817 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 53                                             |
| -90 ~ -80                               | 54                                             |
| -80 ~ -70                               | 55                                             |
| -70 ~ -60                               | 57                                             |
| -60 ~ -50                               | 58                                             |
| -50 ~ -40                               | 59                                             |
| -40 ~ -30                               | 60                                             |
| -30 ~ -20                               | 61                                             |
| -20 ~ -10                               | 62                                             |
| -10 ~ 0                                 | 64                                             |
| 0 ~ 10                                  | 65                                             |
| 10 ~ 20                                 | 66                                             |
| 20 ~ 30                                 | 67                                             |
| 30 ~ 40                                 | 68                                             |
| 40 ~ 50                                 | 69                                             |
| 50 ~ 60                                 | 70                                             |
| 60 ~ 70                                 | 71                                             |
| 70 ~ 80                                 | 72                                             |
| 80 ~ 90                                 | 73                                             |
| 90 ~ 100                                | 73                                             |
| 100 ~ 110                               | 74                                             |
| 110 ~ 120                               | 75                                             |
| 120 ~ 130                               | 76                                             |
| 130 ~ 140                               | 77                                             |
| 140 ~ 150                               | 77                                             |
| 150 ~ 160                               | 78                                             |
| 160 ~ 170                               | 79                                             |
| 170 ~ 180                               | 79                                             |
| 180 ~ 190                               | 80                                             |
| 190 ~ 200                               | 81                                             |
| 200 ~ 210                               | 81                                             |
| 210 ~ 220                               | 82                                             |
| 220 ~ 230                               | 82                                             |
| 230 ~ 240                               | 83                                             |
| 240 ~ 250                               | 83                                             |
| 250 ~ 260                               | 84                                             |
| 260 ~ 270                               | 84                                             |
| 270 ~ 280                               | 85                                             |
| 280 ~ 290                               | 85                                             |
| 290 ~ 300                               | 86                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.71 |
| Specific Gravity $d$                                     | 4.89 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | 3.8                                                             | 4.0 | 4.6 | 4.8 | 4.9 | 5.2 | 5.5 | 6.2 | 6.3 | 7.2 | 8.3  | - |
| -60 ~ -40                                    | 3.8                                                             | 4.1 | 4.7 | 4.9 | 4.9 | 5.2 | 5.6 | 6.3 | 6.4 | 7.3 | 8.4  | - |
| -40 ~ -20                                    | 3.8                                                             | 4.2 | 4.8 | 5.0 | 5.0 | 5.3 | 5.7 | 6.5 | 6.6 | 7.5 | 8.6  | - |
| -20 ~ 0                                      | 4.0                                                             | 4.3 | 4.9 | 5.1 | 5.2 | 5.6 | 5.9 | 6.7 | 6.8 | 7.8 | 8.9  | - |
| 0 ~ 20                                       | 4.2                                                             | 4.5 | 5.1 | 5.3 | 5.3 | 5.8 | 6.2 | 6.9 | 7.1 | 8.1 | 9.2  | - |
| 20 ~ 40                                      | 4.3                                                             | 4.7 | 5.3 | 5.5 | 5.6 | 5.9 | 6.3 | 7.2 | 7.3 | 8.4 | 9.6  | - |
| 40 ~ 60                                      | 4.5                                                             | 4.8 | 5.4 | 5.7 | 5.7 | 6.1 | 6.5 | 7.4 | 7.6 | 8.7 | 9.9  | - |
| 60 ~ 80                                      | 4.5                                                             | 4.9 | 5.7 | 5.9 | 6.0 | 6.3 | 6.7 | 7.6 | 7.7 | 8.9 | 10.1 | - |
| 80 ~ 100                                     | 4.6                                                             | 5.0 | 5.7 | 5.9 | 6.0 | 6.4 | 6.8 | 7.8 | 7.9 | 9.1 | 10.4 | - |
| 100 ~ 120                                    | 4.7                                                             | 5.1 | 5.8 | 6.0 | 6.1 | 6.5 | 7.0 | 7.9 | 8.0 | 9.2 | 10.7 | - |
| 120 ~ 140                                    | 4.7                                                             | 5.1 | 5.8 | 6.1 | 6.1 | 6.6 | 7.0 | 8.0 | 8.1 | 9.3 | 10.8 | - |
| 140 ~ 160                                    | 4.6                                                             | 5.0 | 5.8 | 6.1 | 6.1 | 6.6 | 7.0 | 8.0 | 8.1 | 9.5 | 10.9 | - |
| 160 ~ 180                                    | 4.5                                                             | 4.9 | 5.8 | 6.1 | 6.2 | 6.6 | 7.1 | 8.1 | 8.2 | 9.5 | 11.0 | - |

L-LAL13

Code(d) 694532  
Code(e) 697529

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.693 50<br>1.693 500 | Abbe Number $\nu_d$ | 53.18 | Dispersion $n_F - n_C$       | 0.013 040 |
| Refractive Index $n_e$ | 1.696 607             | Abbe Number $\nu_e$ | 52.93 | Dispersion $n_{F'} - n_{C'}$ | 0.013 160 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.657 37 |
| $n_{1970}$         | 1.970 09  | 1.663 92 |
| $n_{1530}$         | 1.529 58  | 1.670 89 |
| $n_{1129}$         | 1.128 64  | 1.677 02 |
| $n_t$              | 1.013 98  | 1.679 06 |
| $n_s$              | 0.852 11  | 1.682 63 |
| $n_{A'}$           | 0.768 19  | 1.685 07 |
| $n_F$              | 0.706 52  | 1.687 31 |
| $n_C$              | 0.656 27  | 1.689 55 |
| $n_{C'}$           | 0.643 85  | 1.690 18 |
| $n_{He-Ne}$        | 0.632 8   | 1.690 76 |
| $n_D$              | 0.589 29  | 1.693 38 |
| $n_d$              | 0.587 56  | 1.693 50 |
| $n_e$              | 0.546 07  | 1.696 61 |
| $n_F$              | 0.486 13  | 1.702 59 |
| $n_{F'}$           | 0.479 99  | 1.703 34 |
| $n_{He-Cd}$        | 0.441 57  | 1.708 79 |
| $n_g$              | 0.435 835 | 1.709 74 |
| $n_h$              | 0.404 656 | 1.715 70 |
| $n_i$              | 0.365 015 | 1.725 92 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.177 761 46E+00 |
| $A_2$                           | 6.345 913 45E-01 |
| $A_3$                           | 1.204 356 49E+00 |
| $B_1$                           | 5.576 182 43E-03 |
| $B_2$                           | 2.068 214 69E-02 |
| $B_3$                           | 9.963 227 76E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 53.2 |
| Phosphate Resistance PR                   | 4.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 107.8 |
| Rigidity Modulus G (GPa) | 41.9  |
| Poisson's Ratio $\sigma$ | 0.285 |
| Knoop Hardness Hk[Class] | 640 6 |
| Abrasion Aa              | 108   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 490 |
| $n_C - n_{A'}$      | 0.004 481 |
| $n_d - n_C$         | 0.003 949 |
| $n_e - n_C$         | 0.007 056 |
| $n_g - n_d$         | 0.016 239 |
| $n_g - n_F$         | 0.007 148 |
| $n_h - n_g$         | 0.005 962 |
| $n_i - n_g$         | 0.016 179 |
| $n_{C'} - n_t$      | 0.011 117 |
| $n_e - n_{C'}$      | 0.006 429 |
| $n_{F'} - n_e$      | 0.006 731 |
| $n_i - n_{F'}$      | 0.022 580 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.804 4 |
| $\theta_{C,A'}$              | 0.343 6 |
| $\theta_{d,C}$               | 0.302 8 |
| $\theta_{e,C}$               | 0.541 1 |
| $\theta_{g,d}$               | 1.245 3 |
| $\theta_{g,F}$               | 0.548 2 |
| $\theta_{h,g}$               | 0.457 2 |
| $\theta_{i,g}$               | 1.240 7 |
| $\theta'_{C,t}$              | 0.844 8 |
| $\theta'_{e,C'}$             | 0.488 5 |
| $\theta'_{F',e}$             | 0.511 5 |
| $\theta'_{i,F'}$             | 1.715 8 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.008 2  |
| $\Delta\theta_{C,A'}$ | 0.003 3  |
| $\Delta\theta_{g,d}$  | -0.009 0 |
| $\Delta\theta_{g,F}$  | -0.007 2 |
| $\Delta\theta_{i,g}$  | -0.039 0 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 360  | $\lambda_5$      | 285 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 346  | $\lambda_{0.05}$ | 288 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.35 | 0.32             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.01             |
| 290                    | 0.06             |
| 300                    | 0.15             |
| 310                    | 0.28             |
| 320                    | 0.45             |
| 330                    | 0.61             |
| 340                    | 0.74             |
| 350                    | 0.84             |
| 360                    | 0.913            |
| 370                    | 0.949            |
| 380                    | 0.969            |
| 390                    | 0.979            |
| 400                    | 0.984            |
| 420                    | 0.989            |
| 440                    | 0.991            |
| 460                    | 0.993            |
| 480                    | 0.995            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.996            |
| 1 600                  | 0.995            |
| 1 800                  | 0.988            |
| 2 000                  | 0.969            |
| 2 200                  | 0.918            |
| 2 400                  | 0.72             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 503   |
| Annealing Point AP (°C)                                          | 522   |
| Transformation Temperature Tg (°C)                               | 538   |
| Yield Point At (°C)                                              | 583   |
| Softening Point SP (°C)                                          | 615   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 75    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 93    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.887 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 58                                             |
| -90 ~ -80                               | 60                                             |
| -80 ~ -70                               | 62                                             |
| -70 ~ -60                               | 63                                             |
| -60 ~ -50                               | 65                                             |
| -50 ~ -40                               | 66                                             |
| -40 ~ -30                               | 68                                             |
| -30 ~ -20                               | 69                                             |
| -20 ~ -10                               | 71                                             |
| -10 ~ 0                                 | 72                                             |
| 0 ~ 10                                  | 73                                             |
| 10 ~ 20                                 | 75                                             |
| 20 ~ 30                                 | 76                                             |
| 30 ~ 40                                 | 77                                             |
| 40 ~ 50                                 | 78                                             |
| 50 ~ 60                                 | 80                                             |
| 60 ~ 70                                 | 81                                             |
| 70 ~ 80                                 | 82                                             |
| 80 ~ 90                                 | 83                                             |
| 90 ~ 100                                | 84                                             |
| 100 ~ 110                               | 85                                             |
| 110 ~ 120                               | 86                                             |
| 120 ~ 130                               | 87                                             |
| 130 ~ 140                               | 88                                             |
| 140 ~ 150                               | 89                                             |
| 150 ~ 160                               | 90                                             |
| 160 ~ 170                               | 91                                             |
| 170 ~ 180                               | 92                                             |
| 180 ~ 190                               | 93                                             |
| 190 ~ 200                               | 93                                             |
| 200 ~ 210                               | 94                                             |
| 210 ~ 220                               | 95                                             |
| 220 ~ 230                               | 96                                             |
| 230 ~ 240                               | 96                                             |
| 240 ~ 250                               | 97                                             |
| 250 ~ 260                               | 98                                             |
| 260 ~ 270                               | 98                                             |
| 270 ~ 280                               | 99                                             |
| 280 ~ 290                               | 99                                             |
| 290 ~ 300                               | 100                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.91 |
| Specific Gravity $d$                                      | 3.69 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.9                                                             | 2.1 | 2.5 | 2.5 | 2.6 | 2.7 | 2.9 | 3.2 | 3.3 | 3.7 | 4.1 | 4.9 |
| -60 ~ -40                                    | 1.8                                                             | 1.9 | 2.2 | 2.3 | 2.4 | 2.5 | 2.7 | 3.1 | 3.2 | 3.5 | 3.9 | 4.8 |
| -40 ~ -20                                    | 1.6                                                             | 1.9 | 2.2 | 2.3 | 2.3 | 2.5 | 2.7 | 3.0 | 3.0 | 3.5 | 4.0 | 4.7 |
| -20 ~ 0                                      | 1.7                                                             | 1.8 | 2.1 | 2.3 | 2.4 | 2.5 | 2.7 | 3.1 | 3.1 | 3.5 | 3.9 | 4.8 |
| 0 ~ 20                                       | 1.7                                                             | 1.9 | 2.3 | 2.4 | 2.4 | 2.6 | 2.7 | 3.1 | 3.2 | 3.6 | 4.1 | 4.9 |
| 20 ~ 40                                      | 1.8                                                             | 1.9 | 2.4 | 2.5 | 2.5 | 2.7 | 2.9 | 3.2 | 3.3 | 3.7 | 4.1 | 5.1 |
| 40 ~ 60                                      | 1.9                                                             | 2.1 | 2.4 | 2.5 | 2.6 | 2.8 | 2.9 | 3.3 | 3.4 | 3.8 | 4.3 | 5.2 |
| 60 ~ 80                                      | 2.0                                                             | 2.1 | 2.5 | 2.7 | 2.6 | 2.8 | 3.1 | 3.5 | 3.6 | 4.0 | 4.5 | 5.3 |
| 80 ~ 100                                     | 2.1                                                             | 2.3 | 2.6 | 2.7 | 2.8 | 3.0 | 3.2 | 3.6 | 3.6 | 4.2 | 4.6 | 5.5 |
| 100 ~ 120                                    | 2.2                                                             | 2.4 | 2.7 | 2.9 | 2.9 | 3.1 | 3.3 | 3.7 | 3.7 | 4.2 | 4.8 | 5.7 |
| 120 ~ 140                                    | 2.2                                                             | 2.4 | 2.8 | 2.9 | 3.0 | 3.2 | 3.4 | 3.8 | 3.8 | 4.4 | 4.9 | 5.8 |
| 140 ~ 160                                    | 2.3                                                             | 2.5 | 3.0 | 3.1 | 3.1 | 3.3 | 3.6 | 4.0 | 4.0 | 4.5 | 5.0 | 6.0 |
| 160 ~ 180                                    | 2.4                                                             | 2.6 | 3.0 | 3.2 | 3.2 | 3.4 | 3.6 | 4.0 | 4.1 | 4.6 | 5.1 | 6.0 |

L-LAL15

Code(d) 693529  
Code(e) 696527

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.693 04<br>1.693 040 | Abbe Number $\nu_d$ | 52.93 | Dispersion $n_F - n_C$       | 0.013 093 |
| Refractive Index $n_e$ | 1.696 160             | Abbe Number $\nu_e$ | 52.70 | Dispersion $n_{F'} - n_{C'}$ | 0.013 210 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.654 55 |
| $n_{1970}$         | 1.970 09  | 1.661 89 |
| $n_{1530}$         | 1.529 58  | 1.669 60 |
| $n_{1129}$         | 1.128 64  | 1.676 21 |
| $n_t$              | 1.013 98  | 1.678 35 |
| $n_s$              | 0.852 11  | 1.682 03 |
| $n_{A'}$           | 0.768 19  | 1.684 53 |
| $n_F$              | 0.706 52  | 1.686 80 |
| $n_C$              | 0.656 27  | 1.689 06 |
| $n_{C'}$           | 0.643 85  | 1.689 70 |
| $n_{He-Ne}$        | 0.632 8   | 1.690 29 |
| $n_D$              | 0.589 29  | 1.692 92 |
| $n_d$              | 0.587 56  | 1.693 04 |
| $n_e$              | 0.546 07  | 1.696 16 |
| $n_F$              | 0.486 13  | 1.702 16 |
| $n_{F'}$           | 0.479 99  | 1.702 91 |
| $n_{He-Cd}$        | 0.441 57  | 1.708 37 |
| $n_g$              | 0.435 835 | 1.709 32 |
| $n_h$              | 0.404 656 | 1.715 28 |
| $n_i$              | 0.365 015 | 1.725 50 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.079 596 34E+00 |
| $A_2$                           | 7.318 721 34E-01 |
| $A_3$                           | 1.171 111 07E+00 |
| $B_1$                           | 4.700 475 43E-03 |
| $B_2$                           | 1.986 157 58E-02 |
| $B_3$                           | 8.703 599 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 53.0 |
| Phosphate Resistance PR                   | 4.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 110.3 |
| Rigidity Modulus G (GPa) | 42.7  |
| Poisson's Ratio $\sigma$ | 0.291 |
| Knoop Hardness Hk[Class] | 660 7 |
| Abrasion Aa              | 82    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 719 |
| $n_C - n_{A'}$      | 0.004 537 |
| $n_d - n_C$         | 0.003 975 |
| $n_e - n_C$         | 0.007 095 |
| $n_g - n_d$         | 0.016 276 |
| $n_g - n_F$         | 0.007 158 |
| $n_h - n_g$         | 0.005 966 |
| $n_i - n_g$         | 0.016 189 |
| $n_{C'} - n_t$      | 0.011 351 |
| $n_e - n_{C'}$      | 0.006 463 |
| $n_{F'} - n_e$      | 0.006 747 |
| $n_i - n_{F'}$      | 0.022 598 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.818 7 |
| $\theta_{C,A'}$              | 0.346 5 |
| $\theta_{d,C}$               | 0.303 6 |
| $\theta_{e,C}$               | 0.541 9 |
| $\theta_{g,d}$               | 1.243 1 |
| $\theta_{g,F}$               | 0.546 7 |
| $\theta_{h,g}$               | 0.455 7 |
| $\theta_{i,g}$               | 1.236 5 |
| $\theta'_{C,t}$              | 0.859 3 |
| $\theta'_{e,C'}$             | 0.489 3 |
| $\theta'_{F,e}$              | 0.510 7 |
| $\theta'_{i,F'}$             | 1.710 7 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.023 7  |
| $\Delta\theta_{C,A'}$ | 0.006 5  |
| $\Delta\theta_{g,d}$  | -0.011 7 |
| $\Delta\theta_{g,F}$  | -0.009 1 |
| $\Delta\theta_{i,g}$  | -0.045 3 |

| Coloring              |      |                  |  |
|-----------------------|------|------------------|--|
| $\lambda_{80}$        | 345  | $\lambda_5$      |  |
| $\lambda_{70}$        |      |                  |  |
|                       |      |                  |  |
| Internal transmission |      |                  |  |
| $\lambda_{0.80}$      | 320  | $\lambda_{0.05}$ |  |
|                       |      |                  |  |
| CCI                   |      |                  |  |
| B                     | G    | R                |  |
| 0.00                  | 0.14 | 0.14             |  |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.39             |
| 290                    | 0.53             |
| 300                    | 0.64             |
| 310                    | 0.73             |
| 320                    | 0.80             |
| 330                    | 0.87             |
| 340                    | 0.916            |
| 350                    | 0.948            |
| 360                    | 0.968            |
| 370                    | 0.980            |
| 380                    | 0.987            |
| 390                    | 0.991            |
| 400                    | 0.993            |
| 420                    | 0.995            |
| 440                    | 0.997            |
| 460                    | 0.997            |
| 480                    | 0.998            |
| 500                    | 0.999            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.990            |
| 1 600                  | 0.991            |
| 1 800                  | 0.979            |
| 2 000                  | 0.949            |
| 2 200                  | 0.85             |
| 2 400                  | 0.59             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 494   |
| Annealing Point AP (°C)                                          | 515   |
| Transformation Temperature Tg (°C)                               | 537   |
| Yield Point At (°C)                                              | 570   |
| Softening Point SP (°C)                                          | 596   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 57    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 74    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.923 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 42                                             |
| -90 ~ -80                               | 43                                             |
| -80 ~ -70                               | 44                                             |
| -70 ~ -60                               | 46                                             |
| -60 ~ -50                               | 47                                             |
| -50 ~ -40                               | 49                                             |
| -40 ~ -30                               | 50                                             |
| -30 ~ -20                               | 51                                             |
| -20 ~ -10                               | 52                                             |
| -10 ~ 0                                 | 54                                             |
| 0 ~ 10                                  | 55                                             |
| 10 ~ 20                                 | 56                                             |
| 20 ~ 30                                 | 57                                             |
| 30 ~ 40                                 | 58                                             |
| 40 ~ 50                                 | 60                                             |
| 50 ~ 60                                 | 61                                             |
| 60 ~ 70                                 | 62                                             |
| 70 ~ 80                                 | 63                                             |
| 80 ~ 90                                 | 64                                             |
| 90 ~ 100                                | 65                                             |
| 100 ~ 110                               | 66                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 69                                             |
| 140 ~ 150                               | 70                                             |
| 150 ~ 160                               | 71                                             |
| 160 ~ 170                               | 72                                             |
| 170 ~ 180                               | 73                                             |
| 180 ~ 190                               | 73                                             |
| 190 ~ 200                               | 74                                             |
| 200 ~ 210                               | 75                                             |
| 210 ~ 220                               | 76                                             |
| 220 ~ 230                               | 77                                             |
| 230 ~ 240                               | 77                                             |
| 240 ~ 250                               | 78                                             |
| 250 ~ 260                               | 79                                             |
| 260 ~ 270                               | 79                                             |
| 270 ~ 280                               | 80                                             |
| 280 ~ 290                               | 81                                             |
| 290 ~ 300                               | 81                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.44 |
| Specific Gravity $d$                                     | 3.66 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 5.6                                                             | 5.8 | 6.2 | 6.3 | 6.3 | 6.5 | 6.6 | 7.0 | 7.1 | 7.5 | 7.8 | 8.6  |
| -60 ~ -40                                    | 5.5                                                             | 5.7 | 6.0 | 6.2 | 6.2 | 6.4 | 6.5 | 7.0 | 7.0 | 7.4 | 7.8 | 8.6  |
| -40 ~ -20                                    | 5.4                                                             | 5.7 | 6.1 | 6.2 | 6.2 | 6.4 | 6.6 | 6.9 | 7.0 | 7.5 | 7.9 | 8.7  |
| -20 ~ 0                                      | 5.5                                                             | 5.7 | 6.2 | 6.3 | 6.3 | 6.5 | 6.7 | 7.1 | 7.1 | 7.6 | 8.0 | 8.9  |
| 0 ~ 20                                       | 5.5                                                             | 5.8 | 6.2 | 6.3 | 6.4 | 6.6 | 6.8 | 7.2 | 7.2 | 7.7 | 8.1 | 9.1  |
| 20 ~ 40                                      | 5.6                                                             | 5.8 | 6.3 | 6.5 | 6.5 | 6.7 | 6.9 | 7.4 | 7.4 | 7.9 | 8.4 | 9.4  |
| 40 ~ 60                                      | 5.8                                                             | 6.0 | 6.4 | 6.6 | 6.6 | 6.8 | 7.1 | 7.5 | 7.6 | 8.1 | 8.6 | 9.6  |
| 60 ~ 80                                      | 5.8                                                             | 6.1 | 6.5 | 6.7 | 6.7 | 7.0 | 7.3 | 7.7 | 7.8 | 8.3 | 8.9 | 9.9  |
| 80 ~ 100                                     | 5.9                                                             | 6.2 | 6.6 | 6.8 | 6.8 | 7.1 | 7.3 | 7.8 | 7.9 | 8.5 | 9.1 | 10.1 |
| 100 ~ 120                                    | 6.0                                                             | 6.3 | 6.8 | 6.9 | 7.0 | 7.2 | 7.5 | 8.0 | 8.0 | 8.6 | 9.3 | 10.4 |
| 120 ~ 140                                    | 6.1                                                             | 6.3 | 6.9 | 7.0 | 7.1 | 7.3 | 7.6 | 8.1 | 8.2 | 8.9 | 9.5 | 10.6 |
| 140 ~ 160                                    | 6.1                                                             | 6.4 | 7.0 | 7.2 | 7.2 | 7.5 | 7.8 | 8.3 | 8.4 | 9.0 | 9.6 | 10.8 |
| 160 ~ 180                                    | 6.2                                                             | 6.5 | 7.0 | 7.2 | 7.3 | 7.5 | 7.8 | 8.4 | 8.5 | 9.1 | 9.8 | 11.0 |

L-LAM60

Code(d) 743493  
Code(e) 747490

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.743 20<br>1.743 198 | Abbe Number $\nu_d$ | 49.29 | Dispersion $n_F - n_C$       | 0.015 077 |
| Refractive Index $n_e$ | 1.746 788             | Abbe Number $\nu_e$ | 49.05 | Dispersion $n_{F'} - n_{C'}$ | 0.015 226 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.704 09 |
| $n_{1970}$         | 1.970 09  | 1.710 82 |
| $n_{1530}$         | 1.529 58  | 1.718 04 |
| $n_{1129}$         | 1.128 64  | 1.724 58 |
| $n_t$              | 1.013 98  | 1.726 81 |
| $n_s$              | 0.852 11  | 1.730 78 |
| $n_{A'}$           | 0.768 19  | 1.733 54 |
| $n_F$              | 0.706 52  | 1.736 09 |
| $n_C$              | 0.656 27  | 1.738 66 |
| $n_{C'}$           | 0.643 85  | 1.739 37 |
| $n_{He-Ne}$        | 0.632 8   | 1.740 05 |
| $n_D$              | 0.589 29  | 1.743 06 |
| $n_d$              | 0.587 56  | 1.743 20 |
| $n_e$              | 0.546 07  | 1.746 79 |
| $n_F$              | 0.486 13  | 1.753 73 |
| $n_{F'}$           | 0.479 99  | 1.754 60 |
| $n_{He-Cd}$        | 0.441 57  | 1.760 96 |
| $n_g$              | 0.435 835 | 1.762 07 |
| $n_h$              | 0.404 656 | 1.769 05 |
| $n_i$              | 0.365 015 | 1.781 08 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.475 741 84E+00 |
| $A_2$                           | 4.961 327 43E-01 |
| $A_3$                           | 1.237 962 36E+00 |
| $B_1$                           | 7.369 500 00E-03 |
| $B_2$                           | 2.518 917 46E-02 |
| $B_3$                           | 9.803 066 51E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 114.7 |
| Rigidity Modulus G (GPa) | 44.5  |
| Poisson's Ratio $\sigma$ | 0.289 |
| Knoop Hardness Hk[Class] | 670 7 |
| Abrasion Aa              | 92    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 847 |
| $n_C - n_{A'}$      | 0.005 115 |
| $n_d - n_C$         | 0.004 543 |
| $n_e - n_C$         | 0.008 133 |
| $n_g - n_d$         | 0.018 870 |
| $n_g - n_F$         | 0.008 336 |
| $n_h - n_g$         | 0.006 984 |
| $n_i - n_g$         | 0.019 016 |
| $n_{C'} - n_t$      | 0.012 567 |
| $n_e - n_{C'}$      | 0.007 413 |
| $n_{F'} - n_e$      | 0.007 813 |
| $n_i - n_{F'}$      | 0.026 483 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.785 8 |
| $\theta_{C,A'}$              | 0.339 3 |
| $\theta_{d,C}$               | 0.301 3 |
| $\theta_{e,C}$               | 0.539 4 |
| $\theta_{g,d}$               | 1.251 6 |
| $\theta_{g,F}$               | 0.552 9 |
| $\theta_{h,g}$               | 0.463 2 |
| $\theta_{i,g}$               | 1.261 3 |
| $\theta'_{C,t}$              | 0.825 4 |
| $\theta'_{e,C'}$             | 0.486 9 |
| $\theta'_{F',e}$             | 0.513 1 |
| $\theta'_{i,F'}$             | 1.739 3 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.007 9  |
| $\Delta\theta_{C,A'}$ | 0.003 7  |
| $\Delta\theta_{g,d}$  | -0.010 8 |
| $\Delta\theta_{g,F}$  | -0.008 8 |
| $\Delta\theta_{i,g}$  | -0.051 0 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 370  | $\lambda_5$      | 310 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 347  | $\lambda_{0.05}$ | 308 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.37 | 0.38             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.09             |
| 320                    | 0.33             |
| 330                    | 0.56             |
| 340                    | 0.72             |
| 350                    | 0.83             |
| 360                    | 0.904            |
| 370                    | 0.944            |
| 380                    | 0.965            |
| 390                    | 0.977            |
| 400                    | 0.983            |
| 420                    | 0.988            |
| 440                    | 0.991            |
| 460                    | 0.993            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.997            |
| 1 800                  | 0.991            |
| 2 000                  | 0.974            |
| 2 200                  | 0.936            |
| 2 400                  | 0.75             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 511   |
| Annealing Point AP (°C)                                          | 533   |
| Transformation Temperature Tg (°C)                               | 541   |
| Yield Point At (°C)                                              | 587   |
| Softening Point SP (°C)                                          | 623   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 75    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 92    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.876 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 58                                             |
| -90 ~ -80                               | 59                                             |
| -80 ~ -70                               | 61                                             |
| -70 ~ -60                               | 63                                             |
| -60 ~ -50                               | 64                                             |
| -50 ~ -40                               | 66                                             |
| -40 ~ -30                               | 67                                             |
| -30 ~ -20                               | 69                                             |
| -20 ~ -10                               | 70                                             |
| -10 ~ 0                                 | 71                                             |
| 0 ~ 10                                  | 73                                             |
| 10 ~ 20                                 | 74                                             |
| 20 ~ 30                                 | 75                                             |
| 30 ~ 40                                 | 76                                             |
| 40 ~ 50                                 | 78                                             |
| 50 ~ 60                                 | 79                                             |
| 60 ~ 70                                 | 80                                             |
| 70 ~ 80                                 | 81                                             |
| 80 ~ 90                                 | 82                                             |
| 90 ~ 100                                | 83                                             |
| 100 ~ 110                               | 84                                             |
| 110 ~ 120                               | 85                                             |
| 120 ~ 130                               | 86                                             |
| 130 ~ 140                               | 87                                             |
| 140 ~ 150                               | 88                                             |
| 150 ~ 160                               | 89                                             |
| 160 ~ 170                               | 90                                             |
| 170 ~ 180                               | 91                                             |
| 180 ~ 190                               | 92                                             |
| 190 ~ 200                               | 92                                             |
| 200 ~ 210                               | 93                                             |
| 210 ~ 220                               | 94                                             |
| 220 ~ 230                               | 95                                             |
| 230 ~ 240                               | 95                                             |
| 240 ~ 250                               | 96                                             |
| 250 ~ 260                               | 96                                             |
| 260 ~ 270                               | 97                                             |
| 270 ~ 280                               | 98                                             |
| 280 ~ 290                               | 98                                             |
| 290 ~ 300                               | 99                                             |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 1.83 |
| Specific Gravity $d$                        | 4.20 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.7                                                             | 2.8 | 3.2 | 3.4 | 3.4 | 3.6 | 3.7 | 4.1 | 4.1 | 4.6 | 5.0 | 5.9 |
| -60 ~ -40                                    | 2.4                                                             | 2.7 | 3.0 | 3.2 | 3.2 | 3.4 | 3.6 | 4.0 | 4.1 | 4.5 | 4.9 | 5.8 |
| -40 ~ -20                                    | 2.4                                                             | 2.5 | 2.9 | 3.0 | 3.2 | 3.4 | 3.5 | 3.9 | 4.0 | 4.4 | 4.9 | 5.8 |
| -20 ~ 0                                      | 2.4                                                             | 2.6 | 3.0 | 3.1 | 3.1 | 3.3 | 3.5 | 4.0 | 4.1 | 4.6 | 5.0 | 5.9 |
| 0 ~ 20                                       | 2.4                                                             | 2.6 | 3.0 | 3.1 | 3.1 | 3.4 | 3.6 | 4.1 | 4.1 | 4.6 | 5.1 | 6.1 |
| 20 ~ 40                                      | 2.4                                                             | 2.6 | 3.1 | 3.2 | 3.2 | 3.5 | 3.7 | 4.1 | 4.2 | 4.8 | 5.3 | 6.3 |
| 40 ~ 60                                      | 2.5                                                             | 2.7 | 3.1 | 3.3 | 3.3 | 3.5 | 3.8 | 4.3 | 4.4 | 4.9 | 5.5 | 6.5 |
| 60 ~ 80                                      | 2.6                                                             | 2.8 | 3.3 | 3.4 | 3.5 | 3.7 | 3.9 | 4.4 | 4.5 | 5.0 | 5.6 | 6.7 |
| 80 ~ 100                                     | 2.5                                                             | 2.8 | 3.4 | 3.5 | 3.6 | 3.8 | 4.1 | 4.6 | 4.6 | 5.2 | 5.8 | 6.9 |
| 100 ~ 120                                    | 2.6                                                             | 2.8 | 3.3 | 3.5 | 3.5 | 3.8 | 4.2 | 4.7 | 4.8 | 5.4 | 6.0 | 7.1 |
| 120 ~ 140                                    | 2.6                                                             | 2.9 | 3.5 | 3.7 | 3.7 | 4.0 | 4.3 | 4.8 | 4.9 | 5.5 | 6.1 | 7.3 |
| 140 ~ 160                                    | 2.7                                                             | 3.0 | 3.5 | 3.7 | 3.7 | 4.0 | 4.3 | 4.8 | 4.9 | 5.6 | 6.2 | 7.4 |
| 160 ~ 180                                    | 2.7                                                             | 3.0 | 3.5 | 3.7 | 3.8 | 4.0 | 4.3 | 4.9 | 5.0 | 5.7 | 6.3 | 7.6 |

# L-LAM69

Code(d) **731405**  
Code(e) **735403**

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.730 77<br>1.730 770 | Abbe Number $\nu_d$ | 40.51 | Dispersion $n_F - n_C$       | 0.018 040 |
| Refractive Index $n_e$ | 1.735 051             | Abbe Number $\nu_e$ | 40.25 | Dispersion $n_{F'} - n_{C'}$ | 0.018 262 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.688 05 |
| $n_{1970}$         | 1.970 09  | 1.694 88 |
| $n_{1530}$         | 1.529 58  | 1.702 37 |
| $n_{1129}$         | 1.128 64  | 1.709 39 |
| $n_t$              | 1.013 98  | 1.711 85 |
| $n_s$              | 0.852 11  | 1.716 32 |
| $n_{A'}$           | 0.768 19  | 1.719 48 |
| $n_F$              | 0.706 52  | 1.722 43 |
| $n_C$              | 0.656 27  | 1.725 42 |
| $n_{C'}$           | 0.643 85  | 1.726 26 |
| $n_{He-Ne}$        | 0.632 8   | 1.727 05 |
| $n_D$              | 0.589 29  | 1.730 61 |
| $n_d$              | 0.587 56  | 1.730 77 |
| $n_e$              | 0.546 07  | 1.735 05 |
| $n_F$              | 0.486 13  | 1.743 46 |
| $n_{F'}$           | 0.479 99  | 1.744 52 |
| $n_{He-Cd}$        | 0.441 57  | 1.752 40 |
| $n_g$              | 0.435 835 | 1.753 79 |
| $n_h$              | 0.404 656 | 1.762 67 |
| $n_i$              | 0.365 015 | 1.778 58 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.740 389 60E+00 |
| $A_2$                           | 1.769 969 17E-01 |
| $A_3$                           | 1.767 754 13E+00 |
| $B_1$                           | 1.033 988 70E-02 |
| $B_2$                           | 4.848 227 65E-02 |
| $B_3$                           | 1.366 719 96E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 3.1  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 113.3 |
| Rigidity Modulus G (GPa) | 44.5  |
| Poisson's Ratio $\sigma$ | 0.273 |
| Knoop Hardness Hk[Class] | 630   |
| Abrasion Aa              | 121   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.013 567 |
| $n_C - n_{A'}$      | 0.005 939 |
| $n_d - n_C$         | 0.005 354 |
| $n_e - n_C$         | 0.009 635 |
| $n_g - n_d$         | 0.023 019 |
| $n_g - n_F$         | 0.010 333 |
| $n_h - n_g$         | 0.008 885 |
| $n_i - n_g$         | 0.024 789 |
| $n_{C'} - n_t$      | 0.014 410 |
| $n_e - n_{C'}$      | 0.008 792 |
| $n_{F'} - n_e$      | 0.009 470 |
| $n_i - n_{F'}$      | 0.034 057 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.752 1 |
| $\theta_{C,A'}$              | 0.329 2 |
| $\theta_{d,C}$               | 0.296 8 |
| $\theta_{e,C}$               | 0.534 1 |
| $\theta_{g,d}$               | 1.276 0 |
| $\theta_{g,F}$               | 0.572 8 |
| $\theta_{h,g}$               | 0.492 5 |
| $\theta_{i,g}$               | 1.374 1 |
| $\theta'_{C,t}$              | 0.789 1 |
| $\theta'_{e,C'}$             | 0.481 4 |
| $\theta'_{F,e}$              | 0.518 6 |
| $\theta'_{i,F'}$             | 1.864 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.015 4  |
| $\Delta\theta_{C,A'}$ | 0.004 2  |
| $\Delta\theta_{g,d}$  | -0.004 6 |
| $\Delta\theta_{g,F}$  | -0.003 1 |
| $\Delta\theta_{i,g}$  | -0.011 7 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 410  | $\lambda_5$      | 340 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 379  | $\lambda_{0.05}$ | 340 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.88 | 1.91             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.04             |
| 350                    | 0.26             |
| 360                    | 0.53             |
| 370                    | 0.71             |
| 380                    | 0.81             |
| 390                    | 0.87             |
| 400                    | 0.910            |
| 420                    | 0.947            |
| 440                    | 0.963            |
| 460                    | 0.974            |
| 480                    | 0.983            |
| 500                    | 0.989            |
| 550                    | 0.995            |
| 600                    | 0.994            |
| 650                    | 0.994            |
| 700                    | 0.996            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.995            |
| 1 800                  | 0.987            |
| 2 000                  | 0.971            |
| 2 200                  | 0.925            |
| 2 400                  | 0.76             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 461  |
| Annealing Point AP (°C)                                          | 489  |
| Transformation Temperature Tg (°C)                               | 500  |
| Yield Point At (°C)                                              | 539  |
| Softening Point SP (°C)                                          | 574  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 87   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 109  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.11 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 66                                             |
| -90 ~ -80                               | 68                                             |
| -80 ~ -70                               | 70                                             |
| -70 ~ -60                               | 72                                             |
| -60 ~ -50                               | 73                                             |
| -50 ~ -40                               | 75                                             |
| -40 ~ -30                               | 77                                             |
| -30 ~ -20                               | 79                                             |
| -20 ~ -10                               | 81                                             |
| -10 ~ 0                                 | 82                                             |
| 0 ~ 10                                  | 84                                             |
| 10 ~ 20                                 | 86                                             |
| 20 ~ 30                                 | 87                                             |
| 30 ~ 40                                 | 89                                             |
| 40 ~ 50                                 | 90                                             |
| 50 ~ 60                                 | 92                                             |
| 60 ~ 70                                 | 93                                             |
| 70 ~ 80                                 | 95                                             |
| 80 ~ 90                                 | 96                                             |
| 90 ~ 100                                | 97                                             |
| 100 ~ 110                               | 99                                             |
| 110 ~ 120                               | 100                                            |
| 120 ~ 130                               | 101                                            |
| 130 ~ 140                               | 103                                            |
| 140 ~ 150                               | 104                                            |
| 150 ~ 160                               | 105                                            |
| 160 ~ 170                               | 106                                            |
| 170 ~ 180                               | 107                                            |
| 180 ~ 190                               | 108                                            |
| 190 ~ 200                               | 109                                            |
| 200 ~ 210                               | 110                                            |
| 210 ~ 220                               | 111                                            |
| 220 ~ 230                               | 112                                            |
| 230 ~ 240                               | 113                                            |
| 240 ~ 250                               | 114                                            |
| 250 ~ 260                               | 115                                            |
| 260 ~ 270                               | 116                                            |
| 270 ~ 280                               | 116                                            |
| 280 ~ 290                               | 117                                            |
| 290 ~ 300                               | 118                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.03 |
| Specific Gravity $d$                                     | 3.24 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.5                                                             | 1.7 | 2.1 | 2.3 | 2.4 | 2.6 | 2.8 | 3.3 | 3.4 | 4.1 | 4.8 | 6.2 |
| -60 ~ -40                                    | 1.3                                                             | 1.5 | 2.0 | 2.1 | 2.2 | 2.4 | 2.7 | 3.2 | 3.2 | 4.0 | 4.7 | 6.1 |
| -40 ~ -20                                    | 1.2                                                             | 1.4 | 1.8 | 2.0 | 2.0 | 2.4 | 2.6 | 3.2 | 3.3 | 3.9 | 4.7 | 6.3 |
| -20 ~ 0                                      | 1.1                                                             | 1.4 | 1.9 | 2.0 | 2.1 | 2.3 | 2.6 | 3.2 | 3.3 | 4.1 | 4.9 | 6.5 |
| 0 ~ 20                                       | 1.1                                                             | 1.4 | 1.9 | 2.1 | 2.1 | 2.4 | 2.7 | 3.4 | 3.4 | 4.2 | 5.0 | 6.7 |
| 20 ~ 40                                      | 1.2                                                             | 1.4 | 2.0 | 2.1 | 2.2 | 2.5 | 2.8 | 3.4 | 3.5 | 4.4 | 5.2 | 7.0 |
| 40 ~ 60                                      | 1.2                                                             | 1.5 | 2.0 | 2.2 | 2.3 | 2.6 | 2.9 | 3.6 | 3.7 | 4.6 | 5.4 | 7.3 |
| 60 ~ 80                                      | 1.2                                                             | 1.6 | 2.2 | 2.4 | 2.4 | 2.7 | 3.1 | 3.7 | 3.8 | 4.7 | 5.6 | 7.5 |
| 80 ~ 100                                     | 1.3                                                             | 1.6 | 2.2 | 2.4 | 2.6 | 2.8 | 3.2 | 3.9 | 4.0 | 4.9 | 5.9 | 7.9 |
| 100 ~ 120                                    | 1.4                                                             | 1.7 | 2.3 | 2.5 | 2.6 | 2.9 | 3.4 | 4.1 | 4.2 | 5.1 | 6.1 | 8.2 |
| 120 ~ 140                                    | 1.4                                                             | 1.7 | 2.5 | 2.6 | 2.7 | 3.1 | 3.4 | 4.2 | 4.3 | 5.3 | 6.3 | 8.5 |
| 140 ~ 160                                    | 1.6                                                             | 1.9 | 2.5 | 2.8 | 2.8 | 3.2 | 3.6 | 4.4 | 4.5 | 5.5 | 6.5 | 8.7 |
| 160 ~ 180                                    | 1.6                                                             | 1.9 | 2.6 | 2.8 | 2.9 | 3.3 | 3.6 | 4.5 | 4.6 | 5.6 | 6.7 | 9.0 |

OHARA 25-04

# L-TIM28

Code(d) **689310**  
Code(e) **695308**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.689 48</b><br>1.689 480 | Abbe Number $\nu_d$ | <b>31.02</b> | Dispersion $n_F - n_C$       | <b>0.022 225</b> |
| Refractive Index $n_e$ | 1.694 731                    | Abbe Number $\nu_e$ | 30.78        | Dispersion $n_{F'} - n_{C'}$ | 0.022 569        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.646 32 |
| $n_{1970}$         | 1.970 09  | 1.651 89 |
| $n_{1530}$         | 1.529 58  | 1.658 32 |
| $n_{1129}$         | 1.128 64  | 1.665 00 |
| $n_t$              | 1.013 98  | 1.667 56 |
| $n_s$              | 0.852 11  | 1.672 45 |
| $n_{A'}$           | 0.768 19  | 1.676 05 |
| $n_F$              | 0.706 52  | 1.679 49 |
| $n_C$              | 0.656 27  | 1.683 03 |
| $n_{C'}$           | 0.643 85  | 1.684 03 |
| $n_{He-Ne}$        | 0.632 8   | 1.684 98 |
| $n_D$              | 0.589 29  | 1.689 29 |
| $n_d$              | 0.587 56  | 1.689 48 |
| $n_e$              | 0.546 07  | 1.694 73 |
| $n_F$              | 0.486 13  | 1.705 25 |
| $n_{F'}$           | 0.479 99  | 1.706 60 |
| $n_{He-Cd}$        | 0.441 57  | 1.716 74 |
| $n_g$              | 0.435 835 | 1.718 56 |
| $n_h$              | 0.404 656 | 1.730 34 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.527 808 29E+00 |
| $A_2$                           | 2.327 763 67E-01 |
| $A_3$                           | 1.716 387 81E+00 |
| $B_1$                           | 1.141 358 83E-02 |
| $B_2$                           | 5.590 685 66E-02 |
| $B_3$                           | 1.715 118 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 84.5  |   |
| Rigidity Modulus G (GPa) | 33.7  |   |
| Poisson's Ratio $\sigma$ | 0.254 |   |
| Knoop Hardness Hk[Class] | 530   | 5 |
| Abrasion Aa              | 217   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.015 462 |
| $n_C - n_{A'}$      | 0.006 973 |
| $n_d - n_C$         | 0.006 454 |
| $n_e - n_C$         | 0.011 705 |
| $n_g - n_d$         | 0.029 076 |
| $n_g - n_F$         | 0.013 305 |
| $n_h - n_g$         | 0.011 789 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.016 470 |
| $n_e - n_{C'}$      | 0.010 697 |
| $n_{F'} - n_e$      | 0.011 872 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.695 7 |
| $\theta_{C,A'}$              | 0.313 7 |
| $\theta_{d,C}$               | 0.290 4 |
| $\theta_{e,C}$               | 0.526 7 |
| $\theta_{g,d}$               | 1.308 3 |
| $\theta_{g,F}$               | 0.598 7 |
| $\theta_{h,g}$               | 0.530 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.729 8 |
| $\theta'_{e,C'}$             | 0.474 0 |
| $\theta'_{F,e}$              | 0.526 0 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.003 5 |
| $\Delta\theta_{C,A'}$ | 0.000 3 |
| $\Delta\theta_{g,d}$  | 0.008 0 |
| $\Delta\theta_{g,F}$  | 0.007 4 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 400  | $\lambda_5$      | 355 |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 379  | $\lambda_{0.05}$ | 352 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.29 | 1.27             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.01             |
| 360                    | 0.21             |
| 370                    | 0.60             |
| 380                    | 0.82             |
| 390                    | 0.903            |
| 400                    | 0.940            |
| 420                    | 0.969            |
| 440                    | 0.979            |
| 460                    | 0.984            |
| 480                    | 0.988            |
| 500                    | 0.991            |
| 550                    | 0.997            |
| 600                    | 0.996            |
| 650                    | 0.995            |
| 700                    | 0.997            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.995            |
| 1 800                  | 0.980            |
| 2 000                  | 0.962            |
| 2 200                  | 0.927            |
| 2 400                  | 0.89             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 453  |
| Annealing Point AP (°C)                                          | 484  |
| Transformation Temperature Tg (°C)                               | 503  |
| Yield Point At (°C)                                              | 542  |
| Softening Point SP (°C)                                          | 582  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 106  |
| $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 134  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.02 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 82                                             |
| -90 ~ -80                               | 85                                             |
| -80 ~ -70                               | 87                                             |
| -70 ~ -60                               | 89                                             |
| -60 ~ -50                               | 91                                             |
| -50 ~ -40                               | 93                                             |
| -40 ~ -30                               | 96                                             |
| -30 ~ -20                               | 98                                             |
| -20 ~ -10                               | 100                                            |
| -10 ~ 0                                 | 102                                            |
| 0 ~ 10                                  | 104                                            |
| 10 ~ 20                                 | 106                                            |
| 20 ~ 30                                 | 107                                            |
| 30 ~ 40                                 | 109                                            |
| 40 ~ 50                                 | 111                                            |
| 50 ~ 60                                 | 113                                            |
| 60 ~ 70                                 | 115                                            |
| 70 ~ 80                                 | 116                                            |
| 80 ~ 90                                 | 118                                            |
| 90 ~ 100                                | 120                                            |
| 100 ~ 110                               | 121                                            |
| 110 ~ 120                               | 123                                            |
| 120 ~ 130                               | 125                                            |
| 130 ~ 140                               | 126                                            |
| 140 ~ 150                               | 128                                            |
| 150 ~ 160                               | 129                                            |
| 160 ~ 170                               | 130                                            |
| 170 ~ 180                               | 132                                            |
| 180 ~ 190                               | 133                                            |
| 190 ~ 200                               | 134                                            |
| 200 ~ 210                               | 136                                            |
| 210 ~ 220                               | 137                                            |
| 220 ~ 230                               | 138                                            |
| 230 ~ 240                               | 139                                            |
| 240 ~ 250                               | 141                                            |
| 250 ~ 260                               | 142                                            |
| 260 ~ 270                               | 143                                            |
| 270 ~ 280                               | 144                                            |
| 280 ~ 290                               | 145                                            |
| 290 ~ 300                               | 146                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.62 |
| Specific Gravity $d$                                     | 2.88 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |     |     |     |     |   |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | -1.6                                                            | -1.4 | -0.9 | -0.7 | -0.7 | -0.4 | -0.1 | 0.5 | 0.7 | 1.7 | 2.7 | - |
| -60 ~ -40                                    | -1.8                                                            | -1.6 | -1.1 | -0.9 | -0.9 | -0.6 | -0.3 | 0.5 | 0.6 | 1.6 | 2.8 | - |
| -40 ~ -20                                    | -1.9                                                            | -1.7 | -1.1 | -1.0 | -0.9 | -0.6 | -0.3 | 0.5 | 0.6 | 1.7 | 2.9 | - |
| -20 ~ 0                                      | -2.0                                                            | -1.7 | -1.2 | -1.0 | -1.0 | -0.5 | -0.2 | 0.6 | 0.7 | 1.8 | 3.1 | - |
| 0 ~ 20                                       | -2.0                                                            | -1.7 | -1.1 | -0.9 | -0.9 | -0.5 | -0.2 | 0.7 | 0.8 | 1.9 | 3.4 | - |
| 20 ~ 40                                      | -2.0                                                            | -1.8 | -1.1 | -0.9 | -0.8 | -0.5 | -0.1 | 0.8 | 0.9 | 2.1 | 3.5 | - |
| 40 ~ 60                                      | -2.0                                                            | -1.7 | -1.1 | -0.9 | -0.8 | -0.4 | 0.0  | 0.9 | 1.0 | 2.3 | 3.9 | - |
| 60 ~ 80                                      | -2.1                                                            | -1.8 | -1.0 | -0.9 | -0.8 | -0.4 | 0.1  | 1.0 | 1.2 | 2.5 | 4.0 | - |
| 80 ~ 100                                     | -2.1                                                            | -1.8 | -1.1 | -0.9 | -0.8 | -0.4 | 0.1  | 1.1 | 1.3 | 2.7 | 4.3 | - |
| 100 ~ 120                                    | -2.1                                                            | -1.8 | -1.1 | -0.9 | -0.8 | -0.3 | 0.1  | 1.1 | 1.3 | 2.7 | 4.5 | - |
| 120 ~ 140                                    | -2.2                                                            | -1.9 | -1.2 | -0.9 | -0.8 | -0.4 | 0.1  | 1.2 | 1.3 | 2.9 | 4.6 | - |
| 140 ~ 160                                    | -2.3                                                            | -2.0 | -1.2 | -1.0 | -0.9 | -0.3 | 0.2  | 1.3 | 1.4 | 2.9 | 4.7 | - |
| 160 ~ 180                                    | -2.4                                                            | -2.1 | -1.3 | -1.0 | -0.9 | -0.4 | 0.1  | 1.2 | 1.4 | 3.0 | 4.8 | - |

OHARA 25-04

## S-BAH11

Code(d) 667483

Code(e) 670480

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.666 72<br>1.666 718 | Abbe Number $\nu_d$ | 48.32 | Dispersion $n_F - n_C$       | 0.013 797 |
| Refractive Index $n_e$ | 1.670 000             | Abbe Number $\nu_e$ | 48.04 | Dispersion $n_{F'} - n_{C'}$ | 0.013 948 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.633 28 |
| $n_{1970}$         | 1.970 09  | 1.638 66 |
| $n_{1530}$         | 1.529 58  | 1.644 56 |
| $n_{1129}$         | 1.128 64  | 1.650 08 |
| $n_t$              | 1.013 98  | 1.652 01 |
| $n_s$              | 0.852 11  | 1.655 51 |
| $n_{A'}$           | 0.768 19  | 1.657 98 |
| $n_F$              | 0.706 52  | 1.660 27 |
| $n_C$              | 0.656 27  | 1.662 59 |
| $n_{C'}$           | 0.643 85  | 1.663 24 |
| $n_{He-Ne}$        | 0.632 8   | 1.663 85 |
| $n_D$              | 0.589 29  | 1.666 60 |
| $n_d$              | 0.587 56  | 1.666 72 |
| $n_e$              | 0.546 07  | 1.670 00 |
| $n_F$              | 0.486 13  | 1.676 39 |
| $n_{F'}$           | 0.479 99  | 1.677 19 |
| $n_{He-Cd}$        | 0.441 57  | 1.683 09 |
| $n_g$              | 0.435 835 | 1.684 12 |
| $n_h$              | 0.404 656 | 1.690 67 |
| $n_i$              | 0.365 015 | 1.702 13 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.571 388 60E+00 |
| $A_2$                           | 1.478 693 13E-01 |
| $A_3$                           | 1.280 928 46E+00 |
| $B_1$                           | 9.108 079 36E-03 |
| $B_2$                           | 4.024 016 84E-02 |
| $B_3$                           | 1.303 993 67E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 92.9  |
| Rigidity Modulus G (GPa) | 36.5  |
| Poisson's Ratio $\sigma$ | 0.274 |
| Knoop Hardness Hk[Class] | 590   |
| Abrasion Aa              | 153   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 576 |
| $n_C - n_{A'}$      | 0.004 611 |
| $n_d - n_C$         | 0.004 129 |
| $n_e - n_C$         | 0.007 411 |
| $n_g - n_d$         | 0.017 407 |
| $n_g - n_F$         | 0.007 739 |
| $n_h - n_g$         | 0.006 549 |
| $n_i - n_g$         | 0.018 002 |
| $n_{C'} - n_t$      | 0.011 228 |
| $n_e - n_{C'}$      | 0.006 759 |
| $n_{F'} - n_e$      | 0.007 189 |
| $n_i - n_{F'}$      | 0.024 938 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.766 5 |
| $\theta_{C,A'}$              | 0.334 2 |
| $\theta_{d,C}$               | 0.299 3 |
| $\theta_{e,C}$               | 0.537 1 |
| $\theta_{g,d}$               | 1.261 7 |
| $\theta_{g,F}$               | 0.560 9 |
| $\theta_{h,g}$               | 0.474 7 |
| $\theta_{i,g}$               | 1.304 8 |
| $\theta'_{C,t}$              | 0.805 0 |
| $\theta'_{e,C'}$             | 0.484 6 |
| $\theta'_{F,e}$              | 0.515 4 |
| $\theta'_{i,F'}$             | 1.787 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.006 9 |
| $\Delta\theta_{C,A'}$ | -0.000 2 |
| $\Delta\theta_{g,d}$  | -0.002 7 |
| $\Delta\theta_{g,F}$  | -0.002 4 |
| $\Delta\theta_{i,g}$  | -0.015 6 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 380  | $\lambda_5$      | 340 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 375  | $\lambda_{0.05}$ | 340 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.98 | 0.94             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.04             |
| 350                    | 0.27             |
| 360                    | 0.56             |
| 370                    | 0.75             |
| 380                    | 0.86             |
| 390                    | 0.922            |
| 400                    | 0.952            |
| 420                    | 0.975            |
| 440                    | 0.982            |
| 460                    | 0.987            |
| 480                    | 0.991            |
| 500                    | 0.994            |
| 550                    | 0.997            |
| 600                    | 0.995            |
| 650                    | 0.995            |
| 700                    | 0.996            |
| 800                    | 0.997            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.998            |
| 1 400                  | 0.994            |
| 1 600                  | 0.995            |
| 1 800                  | 0.988            |
| 2 000                  | 0.976            |
| 2 200                  | 0.936            |
| 2 400                  | 0.84             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 593   |
| Annealing Point AP (°C)                                          | 617   |
| Transformation Temperature Tg (°C)                               | 626   |
| Yield Point At (°C)                                              | 682   |
| Softening Point SP (°C)                                          | 738   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 70    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 84    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.858 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 57                                             |
| -90 ~ -80                               | 58                                             |
| -80 ~ -70                               | 59                                             |
| -70 ~ -60                               | 61                                             |
| -60 ~ -50                               | 62                                             |
| -50 ~ -40                               | 63                                             |
| -40 ~ -30                               | 64                                             |
| -30 ~ -20                               | 65                                             |
| -20 ~ -10                               | 66                                             |
| -10 ~ 0                                 | 68                                             |
| 0 ~ 10                                  | 69                                             |
| 10 ~ 20                                 | 70                                             |
| 20 ~ 30                                 | 71                                             |
| 30 ~ 40                                 | 72                                             |
| 40 ~ 50                                 | 73                                             |
| 50 ~ 60                                 | 74                                             |
| 60 ~ 70                                 | 75                                             |
| 70 ~ 80                                 | 76                                             |
| 80 ~ 90                                 | 76                                             |
| 90 ~ 100                                | 77                                             |
| 100 ~ 110                               | 78                                             |
| 110 ~ 120                               | 79                                             |
| 120 ~ 130                               | 80                                             |
| 130 ~ 140                               | 80                                             |
| 140 ~ 150                               | 81                                             |
| 150 ~ 160                               | 82                                             |
| 160 ~ 170                               | 83                                             |
| 170 ~ 180                               | 83                                             |
| 180 ~ 190                               | 84                                             |
| 190 ~ 200                               | 85                                             |
| 200 ~ 210                               | 85                                             |
| 210 ~ 220                               | 86                                             |
| 220 ~ 230                               | 86                                             |
| 230 ~ 240                               | 87                                             |
| 240 ~ 250                               | 87                                             |
| 250 ~ 260                               | 88                                             |
| 260 ~ 270                               | 88                                             |
| 270 ~ 280                               | 89                                             |
| 280 ~ 290                               | 89                                             |
| 290 ~ 300                               | 90                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.06 |
| Specific Gravity $d$                                     | 3.59 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.5                                                             | 2.6 | 3.0 | 3.1 | 3.1 | 3.3 | 3.6 | 3.9 | 4.0 | 4.4 | 5.0 | 5.9 |
| -60 ~ -40                                    | 2.3                                                             | 2.5 | 2.9 | 3.0 | 3.0 | 3.2 | 3.4 | 3.8 | 3.9 | 4.4 | 4.9 | 5.8 |
| -40 ~ -20                                    | 2.3                                                             | 2.5 | 2.8 | 2.9 | 3.1 | 3.3 | 3.5 | 3.9 | 3.9 | 4.4 | 4.9 | 6.0 |
| -20 ~ 0                                      | 2.3                                                             | 2.5 | 2.9 | 3.0 | 3.1 | 3.3 | 3.5 | 4.0 | 4.0 | 4.6 | 5.1 | 6.1 |
| 0 ~ 20                                       | 2.4                                                             | 2.6 | 3.1 | 3.2 | 3.2 | 3.5 | 3.7 | 4.1 | 4.2 | 4.7 | 5.2 | 6.2 |
| 20 ~ 40                                      | 2.5                                                             | 2.7 | 3.1 | 3.2 | 3.3 | 3.5 | 3.8 | 4.3 | 4.3 | 4.9 | 5.4 | 6.5 |
| 40 ~ 60                                      | 2.7                                                             | 2.8 | 3.3 | 3.5 | 3.5 | 3.7 | 3.9 | 4.4 | 4.5 | 5.0 | 5.6 | 6.7 |
| 60 ~ 80                                      | 2.8                                                             | 3.0 | 3.4 | 3.5 | 3.6 | 3.8 | 4.1 | 4.5 | 4.7 | 5.3 | 5.9 | 7.0 |
| 80 ~ 100                                     | 2.9                                                             | 3.1 | 3.6 | 3.7 | 3.8 | 4.0 | 4.2 | 4.7 | 4.8 | 5.4 | 6.0 | 7.3 |
| 100 ~ 120                                    | 3.0                                                             | 3.2 | 3.7 | 3.8 | 3.9 | 4.1 | 4.4 | 4.9 | 5.0 | 5.6 | 6.2 | 7.5 |
| 120 ~ 140                                    | 3.1                                                             | 3.3 | 3.8 | 4.0 | 4.0 | 4.3 | 4.5 | 5.0 | 5.1 | 5.7 | 6.4 | 7.7 |
| 140 ~ 160                                    | 3.1                                                             | 3.4 | 3.9 | 4.0 | 4.1 | 4.3 | 4.7 | 5.2 | 5.3 | 6.0 | 6.6 | 7.9 |
| 160 ~ 180                                    | 3.3                                                             | 3.5 | 4.0 | 4.2 | 4.2 | 4.5 | 4.8 | 5.3 | 5.4 | 6.1 | 6.7 | 8.1 |

## S-BAH27

Code(d) 702412

Code(e) 706410

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.701 54<br>1.701 536 | Abbe Number $\nu_d$ | 41.24 | Dispersion $n_F - n_C$       | 0.017 012 |
| Refractive Index $n_e$ | 1.705 571             | Abbe Number $\nu_e$ | 40.95 | Dispersion $n_{F'} - n_{C'}$ | 0.017 228 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.662 53 |
| $n_{1970}$         | 1.970 09  | 1.668 58 |
| $n_{1530}$         | 1.529 58  | 1.675 26 |
| $n_{1129}$         | 1.128 64  | 1.681 60 |
| $n_t$              | 1.013 98  | 1.683 86 |
| $n_s$              | 0.852 11  | 1.688 00 |
| $n_{A'}$           | 0.768 19  | 1.690 94 |
| $n_F$              | 0.706 52  | 1.693 70 |
| $n_C$              | 0.656 27  | 1.696 50 |
| $n_{C'}$           | 0.643 85  | 1.697 29 |
| $n_{He-Ne}$        | 0.632 8   | 1.698 04 |
| $n_D$              | 0.589 29  | 1.701 39 |
| $n_d$              | 0.587 56  | 1.701 54 |
| $n_e$              | 0.546 07  | 1.705 57 |
| $n_F$              | 0.486 13  | 1.713 51 |
| $n_{F'}$           | 0.479 99  | 1.714 52 |
| $n_{He-Cd}$        | 0.441 57  | 1.722 00 |
| $n_g$              | 0.435 835 | 1.723 32 |
| $n_h$              | 0.404 656 | 1.731 80 |
| $n_i$              | 0.365 015 | 1.747 12 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.689 390 52E+00 |
| $A_2$                           | 1.330 810 13E-01 |
| $A_3$                           | 1.411 655 15E+00 |
| $B_1$                           | 1.035 981 93E-02 |
| $B_2$                           | 5.339 822 39E-02 |
| $B_3$                           | 1.265 155 03E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 93.6  |
| Rigidity Modulus G (GPa) | 36.8  |
| Poisson's Ratio $\sigma$ | 0.272 |
| Knoop Hardness Hk[Class] | 580   |
| Abrasion Aa              | 138   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.012 641 |
| $n_C - n_{A'}$      | 0.005 561 |
| $n_d - n_C$         | 0.005 033 |
| $n_e - n_C$         | 0.009 068 |
| $n_g - n_d$         | 0.021 787 |
| $n_g - n_F$         | 0.009 808 |
| $n_h - n_g$         | 0.008 480 |
| $n_i - n_g$         | 0.023 797 |
| $n_{C'} - n_t$      | 0.013 433 |
| $n_e - n_{C'}$      | 0.008 276 |
| $n_{F'} - n_e$      | 0.008 952 |
| $n_i - n_{F'}$      | 0.032 597 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.743 1 |
| $\theta_{C,A'}$              | 0.326 9 |
| $\theta_{d,C}$               | 0.295 8 |
| $\theta_{e,C}$               | 0.533 0 |
| $\theta_{g,d}$               | 1.280 7 |
| $\theta_{g,F}$               | 0.576 5 |
| $\theta_{h,g}$               | 0.498 5 |
| $\theta_{i,g}$               | 1.398 8 |
| $\theta'_{C,t}$              | 0.779 7 |
| $\theta'_{e,C'}$             | 0.480 4 |
| $\theta'_{F',e}$             | 0.519 6 |
| $\theta'_{i,F'}$             | 1.892 1 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.002 9 |
| $\Delta\theta_{C,A'}$ | 0.001 1 |
| $\Delta\theta_{g,d}$  | 0.001 6 |
| $\Delta\theta_{g,F}$  | 0.001 8 |
| $\Delta\theta_{i,g}$  | 0.019 1 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 400  | $\lambda_5$      | 350 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 388  | $\lambda_{0.05}$ | 356 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.99 | 2.01             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.16             |
| 370                    | 0.47             |
| 380                    | 0.70             |
| 390                    | 0.83             |
| 400                    | 0.89             |
| 420                    | 0.955            |
| 440                    | 0.971            |
| 460                    | 0.979            |
| 480                    | 0.985            |
| 500                    | 0.989            |
| 550                    | 0.995            |
| 600                    | 0.994            |
| 650                    | 0.994            |
| 700                    | 0.996            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.993            |
| 1 600                  | 0.994            |
| 1 800                  | 0.987            |
| 2 000                  | 0.974            |
| 2 200                  | 0.921            |
| 2 400                  | 0.81             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 611   |
| Annealing Point AP (°C)                                          | 636   |
| Transformation Temperature Tg (°C)                               | 647   |
| Yield Point At (°C)                                              | 700   |
| Softening Point SP (°C)                                          | 749   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 65    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 77    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.869 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 52                                             |
| -90 ~ -80                               | 53                                             |
| -80 ~ -70                               | 55                                             |
| -70 ~ -60                               | 56                                             |
| -60 ~ -50                               | 57                                             |
| -50 ~ -40                               | 58                                             |
| -40 ~ -30                               | 59                                             |
| -30 ~ -20                               | 60                                             |
| -20 ~ -10                               | 61                                             |
| -10 ~ 0                                 | 62                                             |
| 0 ~ 10                                  | 63                                             |
| 10 ~ 20                                 | 64                                             |
| 20 ~ 30                                 | 65                                             |
| 30 ~ 40                                 | 66                                             |
| 40 ~ 50                                 | 67                                             |
| 50 ~ 60                                 | 68                                             |
| 60 ~ 70                                 | 69                                             |
| 70 ~ 80                                 | 70                                             |
| 80 ~ 90                                 | 70                                             |
| 90 ~ 100                                | 71                                             |
| 100 ~ 110                               | 72                                             |
| 110 ~ 120                               | 73                                             |
| 120 ~ 130                               | 73                                             |
| 130 ~ 140                               | 74                                             |
| 140 ~ 150                               | 75                                             |
| 150 ~ 160                               | 75                                             |
| 160 ~ 170                               | 76                                             |
| 170 ~ 180                               | 77                                             |
| 180 ~ 190                               | 77                                             |
| 190 ~ 200                               | 78                                             |
| 200 ~ 210                               | 78                                             |
| 210 ~ 220                               | 79                                             |
| 220 ~ 230                               | 79                                             |
| 230 ~ 240                               | 80                                             |
| 240 ~ 250                               | 80                                             |
| 250 ~ 260                               | 80                                             |
| 260 ~ 270                               | 81                                             |
| 270 ~ 280                               | 81                                             |
| 280 ~ 290                               | 82                                             |
| 290 ~ 300                               | 82                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.18 |
| Specific Gravity $d$                                     | 3.67 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.2                                                             | 2.4 | 2.8 | 2.9 | 3.0 | 3.2 | 3.4 | 4.0 | 4.0 | 4.6 | 5.3 | 6.9 |
| -60 ~ -40                                    | 2.2                                                             | 2.4 | 2.8 | 2.9 | 2.9 | 3.1 | 3.5 | 4.0 | 4.0 | 4.6 | 5.3 | 7.0 |
| -40 ~ -20                                    | 2.2                                                             | 2.5 | 2.9 | 3.0 | 3.1 | 3.3 | 3.5 | 4.0 | 4.2 | 4.8 | 5.5 | 7.1 |
| -20 ~ 0                                      | 2.3                                                             | 2.5 | 3.0 | 3.2 | 3.2 | 3.5 | 3.7 | 4.2 | 4.3 | 5.0 | 5.7 | 7.4 |
| 0 ~ 20                                       | 2.4                                                             | 2.7 | 3.2 | 3.3 | 3.4 | 3.6 | 3.9 | 4.4 | 4.5 | 5.2 | 6.0 | 7.7 |
| 20 ~ 40                                      | 2.6                                                             | 2.8 | 3.4 | 3.5 | 3.6 | 3.8 | 4.1 | 4.6 | 4.7 | 5.4 | 6.2 | 8.0 |
| 40 ~ 60                                      | 2.8                                                             | 3.1 | 3.5 | 3.7 | 3.7 | 4.0 | 4.2 | 4.8 | 4.9 | 5.6 | 6.5 | 8.3 |
| 60 ~ 80                                      | 2.9                                                             | 3.2 | 3.7 | 3.9 | 3.8 | 4.2 | 4.5 | 5.1 | 5.1 | 5.9 | 6.7 | 8.5 |
| 80 ~ 100                                     | 3.1                                                             | 3.3 | 3.8 | 4.0 | 4.0 | 4.3 | 4.6 | 5.3 | 5.3 | 6.1 | 7.0 | 8.9 |
| 100 ~ 120                                    | 3.2                                                             | 3.4 | 3.9 | 4.1 | 4.1 | 4.4 | 4.7 | 5.3 | 5.4 | 6.2 | 7.2 | 9.1 |
| 120 ~ 140                                    | 3.3                                                             | 3.5 | 4.0 | 4.2 | 4.2 | 4.5 | 4.8 | 5.5 | 5.6 | 6.5 | 7.4 | 9.3 |
| 140 ~ 160                                    | 3.3                                                             | 3.5 | 4.2 | 4.3 | 4.4 | 4.7 | 5.0 | 5.6 | 5.7 | 6.6 | 7.5 | 9.5 |
| 160 ~ 180                                    | 3.4                                                             | 3.6 | 4.2 | 4.4 | 4.4 | 4.7 | 5.0 | 5.7 | 5.8 | 6.6 | 7.6 | 9.6 |

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## S-BAH28

Code(d) 723380

Code(e) 728377

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.723 42<br>1.723 420 | Abbe Number $\nu_d$ | 37.95 | Dispersion $n_F - n_C$       | 0.019 060 |
| Refractive Index $n_e$ | 1.727 935             | Abbe Number $\nu_e$ | 37.68 | Dispersion $n_{F'} - n_{C'}$ | 0.019 320 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.681 98 |
| $n_{1970}$         | 1.970 09  | 1.688 08 |
| $n_{1530}$         | 1.529 58  | 1.694 90 |
| $n_{1129}$         | 1.128 64  | 1.701 54 |
| $n_t$              | 1.013 98  | 1.703 96 |
| $n_s$              | 0.852 11  | 1.708 44 |
| $n_{A'}$           | 0.768 19  | 1.711 67 |
| $n_F$              | 0.706 52  | 1.714 71 |
| $n_C$              | 0.656 27  | 1.717 82 |
| $n_{C'}$           | 0.643 85  | 1.718 70 |
| $n_{He-Ne}$        | 0.632 8   | 1.719 52 |
| $n_D$              | 0.589 29  | 1.723 25 |
| $n_d$              | 0.587 56  | 1.723 42 |
| $n_e$              | 0.546 07  | 1.727 94 |
| $n_F$              | 0.486 13  | 1.736 88 |
| $n_{F'}$           | 0.479 99  | 1.738 02 |
| $n_{He-Cd}$        | 0.441 57  | 1.746 49 |
| $n_g$              | 0.435 835 | 1.748 00 |
| $n_h$              | 0.404 656 | 1.757 69 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.694 934 84E+00 |
| $A_2$                           | 1.928 902 98E-01 |
| $A_3$                           | 1.563 859 48E+00 |
| $B_1$                           | 1.027 231 90E-02 |
| $B_2$                           | 5.211 876 40E-02 |
| $B_3$                           | 1.378 180 35E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 2   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 91.1  |
| Rigidity Modulus G (GPa) | 37.5  |
| Poisson's Ratio $\sigma$ | 0.213 |
| Knoop Hardness Hk[Class] | 600 6 |
| Abrasion Aa              | 131   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.013 857 |
| $n_C - n_{A'}$      | 0.006 146 |
| $n_d - n_C$         | 0.005 604 |
| $n_e - n_C$         | 0.010 119 |
| $n_g - n_d$         | 0.024 580 |
| $n_g - n_F$         | 0.011 124 |
| $n_h - n_g$         | 0.009 689 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.014 736 |
| $n_e - n_{C'}$      | 0.009 240 |
| $n_{F'} - n_e$      | 0.010 080 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.727 0 |
| $\theta_{C,A'}$              | 0.322 5 |
| $\theta_{d,C}$               | 0.294 0 |
| $\theta_{e,C}$               | 0.530 9 |
| $\theta_{g,d}$               | 1.289 6 |
| $\theta_{g,F}$               | 0.583 6 |
| $\theta_{h,g}$               | 0.508 3 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.762 7 |
| $\theta'_{e,C'}$             | 0.478 3 |
| $\theta'_{F',e}$             | 0.521 7 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.002 3 |
| $\Delta\theta_{C,A'}$ | 0.000 6 |
| $\Delta\theta_{g,d}$  | 0.003 7 |
| $\Delta\theta_{g,F}$  | 0.003 5 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 415  | $\lambda_5$      | 355 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 395  | $\lambda_{0.05}$ | 360 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.78 | 2.88             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.06             |
| 370                    | 0.32             |
| 380                    | 0.58             |
| 390                    | 0.75             |
| 400                    | 0.85             |
| 420                    | 0.934            |
| 440                    | 0.963            |
| 460                    | 0.975            |
| 480                    | 0.982            |
| 500                    | 0.987            |
| 550                    | 0.994            |
| 600                    | 0.995            |
| 650                    | 0.995            |
| 700                    | 0.996            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.994            |
| 1 600                  | 0.995            |
| 1 800                  | 0.990            |
| 2 000                  | 0.979            |
| 2 200                  | 0.938            |
| 2 400                  | 0.84             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 599   |
| Annealing Point AP (°C)                                          | 626   |
| Transformation Temperature Tg (°C)                               | 636   |
| Yield Point At (°C)                                              | 691   |
| Softening Point SP (°C)                                          | 739   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 65    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 79    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.889 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 51                                             |
| -90 ~ -80                               | 53                                             |
| -80 ~ -70                               | 54                                             |
| -70 ~ -60                               | 55                                             |
| -60 ~ -50                               | 56                                             |
| -50 ~ -40                               | 57                                             |
| -40 ~ -30                               | 59                                             |
| -30 ~ -20                               | 60                                             |
| -20 ~ -10                               | 61                                             |
| -10 ~ 0                                 | 62                                             |
| 0 ~ 10                                  | 63                                             |
| 10 ~ 20                                 | 64                                             |
| 20 ~ 30                                 | 65                                             |
| 30 ~ 40                                 | 66                                             |
| 40 ~ 50                                 | 67                                             |
| 50 ~ 60                                 | 68                                             |
| 60 ~ 70                                 | 69                                             |
| 70 ~ 80                                 | 70                                             |
| 80 ~ 90                                 | 71                                             |
| 90 ~ 100                                | 71                                             |
| 100 ~ 110                               | 72                                             |
| 110 ~ 120                               | 73                                             |
| 120 ~ 130                               | 74                                             |
| 130 ~ 140                               | 75                                             |
| 140 ~ 150                               | 75                                             |
| 150 ~ 160                               | 76                                             |
| 160 ~ 170                               | 77                                             |
| 170 ~ 180                               | 78                                             |
| 180 ~ 190                               | 78                                             |
| 190 ~ 200                               | 79                                             |
| 200 ~ 210                               | 80                                             |
| 210 ~ 220                               | 80                                             |
| 220 ~ 230                               | 81                                             |
| 230 ~ 240                               | 81                                             |
| 240 ~ 250                               | 82                                             |
| 250 ~ 260                               | 82                                             |
| 260 ~ 270                               | 83                                             |
| 270 ~ 280                               | 83                                             |
| 280 ~ 290                               | 84                                             |
| 290 ~ 300                               | 84                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.31 |
| Specific Gravity $d$                                     | 3.67 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | 3.3                                                             | 3.5 | 3.8 | 3.9 | 3.9 | 4.2 | 4.4 | 4.9 | 5.0 | 5.6 | 6.5 | - |
| -60 ~ -40                                    | 3.2                                                             | 3.3 | 3.8 | 3.9 | 4.0 | 4.2 | 4.4 | 4.9 | 5.0 | 5.8 | 6.6 | - |
| -40 ~ -20                                    | 3.2                                                             | 3.4 | 3.8 | 3.9 | 3.9 | 4.2 | 4.5 | 5.0 | 5.1 | 5.9 | 6.8 | - |
| -20 ~ 0                                      | 3.2                                                             | 3.4 | 3.9 | 4.0 | 4.1 | 4.3 | 4.6 | 5.2 | 5.2 | 6.1 | 7.1 | - |
| 0 ~ 20                                       | 3.3                                                             | 3.5 | 4.0 | 4.1 | 4.2 | 4.4 | 4.7 | 5.3 | 5.4 | 6.3 | 7.3 | - |
| 20 ~ 40                                      | 3.4                                                             | 3.7 | 4.1 | 4.3 | 4.3 | 4.6 | 4.9 | 5.5 | 5.6 | 6.5 | 7.7 | - |
| 40 ~ 60                                      | 3.5                                                             | 3.8 | 4.3 | 4.4 | 4.5 | 4.8 | 5.1 | 5.8 | 5.8 | 6.9 | 8.0 | - |
| 60 ~ 80                                      | 3.6                                                             | 3.9 | 4.5 | 4.6 | 4.7 | 5.0 | 5.3 | 6.0 | 6.1 | 7.1 | 8.2 | - |
| 80 ~ 100                                     | 3.7                                                             | 4.0 | 4.5 | 4.7 | 4.7 | 5.2 | 5.5 | 6.2 | 6.3 | 7.4 | 8.6 | - |
| 100 ~ 120                                    | 3.8                                                             | 4.1 | 4.6 | 4.8 | 4.9 | 5.2 | 5.7 | 6.4 | 6.5 | 7.6 | 8.9 | - |
| 120 ~ 140                                    | 3.8                                                             | 4.1 | 4.7 | 4.9 | 5.0 | 5.3 | 5.7 | 6.6 | 6.7 | 7.8 | 9.1 | - |
| 140 ~ 160                                    | 3.9                                                             | 4.2 | 4.9 | 5.1 | 5.1 | 5.5 | 5.9 | 6.7 | 6.8 | 8.0 | 9.3 | - |
| 160 ~ 180                                    | 3.9                                                             | 4.3 | 4.9 | 5.1 | 5.2 | 5.5 | 5.9 | 6.8 | 6.9 | 8.1 | 9.5 | - |

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## S-BAL 3

Code(d) **571530**  
Code(e) **574527**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.571 35</b><br>1.571 351 | Abbe Number $\nu_d$ | <b>52.95</b> | Dispersion $n_F - n_C$       | <b>0.010 790</b> |
| Refractive Index $n_e$ | 1.573 920                    | Abbe Number $\nu_e$ | 52.65        | Dispersion $n_{F'} - n_{C'}$ | 0.010 900        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.543 61 |
| $n_{1970}$         | 1.970 09  | 1.548 31 |
| $n_{1530}$         | 1.529 58  | 1.553 41 |
| $n_{1129}$         | 1.128 64  | 1.558 06 |
| $n_t$              | 1.013 98  | 1.559 65 |
| $n_s$              | 0.852 11  | 1.562 48 |
| $n_{A'}$           | 0.768 19  | 1.564 45 |
| $n_F$              | 0.706 52  | 1.566 27 |
| $n_C$              | 0.656 27  | 1.568 10 |
| $n_{C'}$           | 0.643 85  | 1.568 62 |
| $n_{He-Ne}$        | 0.632 8   | 1.569 10 |
| $n_D$              | 0.589 29  | 1.571 26 |
| $n_d$              | 0.587 56  | 1.571 35 |
| $n_e$              | 0.546 07  | 1.573 92 |
| $n_F$              | 0.486 13  | 1.578 89 |
| $n_{F'}$           | 0.479 99  | 1.579 52 |
| $n_{He-Cd}$        | 0.441 57  | 1.584 09 |
| $n_g$              | 0.435 835 | 1.584 89 |
| $n_h$              | 0.404 656 | 1.589 93 |
| $n_i$              | 0.365 015 | 1.598 67 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.293 668 90E+00 |
| $A_2$                           | 1.324 402 52E-01 |
| $A_3$                           | 1.101 972 93E+00 |
| $B_1$                           | 8.003 679 62E-03 |
| $B_2$                           | 3.547 111 96E-02 |
| $B_3$                           | 1.345 174 31E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 2   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.2 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 71.9    |
| Rigidity Modulus G (GPa) | 28.8    |
| Poisson's Ratio $\sigma$ | 0.249   |
| Knoop Hardness Hk[Class] | 510   5 |
| Abrasion Aa              | 172     |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 456 |
| $n_C - n_{A'}$      | 0.003 653 |
| $n_d - n_C$         | 0.003 246 |
| $n_e - n_C$         | 0.005 815 |
| $n_g - n_d$         | 0.013 536 |
| $n_g - n_F$         | 0.005 992 |
| $n_h - n_g$         | 0.005 041 |
| $n_i - n_g$         | 0.013 784 |
| $n_{C'} - n_t$      | 0.008 970 |
| $n_e - n_{C'}$      | 0.005 301 |
| $n_{F'} - n_e$      | 0.005 599 |
| $n_i - n_{F'}$      | 0.019 152 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.783 7 |
| $\theta_{C,A'}$              | 0.338 6 |
| $\theta_{d,C}$               | 0.300 8 |
| $\theta_{e,C}$               | 0.538 9 |
| $\theta_{g,d}$               | 1.254 5 |
| $\theta_{g,F}$               | 0.555 3 |
| $\theta_{h,g}$               | 0.467 2 |
| $\theta_{i,g}$               | 1.277 5 |
| $\theta'_{C,t}$              | 0.822 9 |
| $\theta'_{e,C'}$             | 0.486 3 |
| $\theta'_{F',e}$             | 0.513 7 |
| $\theta'_{i,F'}$             | 1.757 1 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.011 4 |
| $\Delta\theta_{C,A'}$ | -0.001 5 |
| $\Delta\theta_{g,d}$  | -0.000 3 |
| $\Delta\theta_{g,F}$  | -0.000 5 |
| $\Delta\theta_{i,g}$  | -0.004 1 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 360  | $\lambda_5$      | 330 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 358  | $\lambda_{0.05}$ | 332 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.24 | 0.25             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.01             |
| 340                    | 0.26             |
| 350                    | 0.63             |
| 360                    | 0.84             |
| 370                    | 0.928            |
| 380                    | 0.963            |
| 390                    | 0.979            |
| 400                    | 0.988            |
| 420                    | 0.994            |
| 440                    | 0.994            |
| 460                    | 0.995            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.996            |
| 1 400                  | 0.991            |
| 1 600                  | 0.990            |
| 1 800                  | 0.972            |
| 2 000                  | 0.945            |
| 2 200                  | 0.88             |
| 2 400                  | 0.83             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 483   |
| Annealing Point AP (°C)                                          | 516   |
| Transformation Temperature Tg (°C)                               | 532   |
| Yield Point At (°C)                                              | 587   |
| Softening Point SP (°C)                                          | 652   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 97    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 116   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.864 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 82                                             |
| -90 ~ -80                               | 84                                             |
| -80 ~ -70                               | 85                                             |
| -70 ~ -60                               | 86                                             |
| -60 ~ -50                               | 87                                             |
| -50 ~ -40                               | 89                                             |
| -40 ~ -30                               | 90                                             |
| -30 ~ -20                               | 91                                             |
| -20 ~ -10                               | 92                                             |
| -10 ~ 0                                 | 94                                             |
| 0 ~ 10                                  | 95                                             |
| 10 ~ 20                                 | 96                                             |
| 20 ~ 30                                 | 97                                             |
| 30 ~ 40                                 | 98                                             |
| 40 ~ 50                                 | 100                                            |
| 50 ~ 60                                 | 101                                            |
| 60 ~ 70                                 | 102                                            |
| 70 ~ 80                                 | 103                                            |
| 80 ~ 90                                 | 104                                            |
| 90 ~ 100                                | 105                                            |
| 100 ~ 110                               | 106                                            |
| 110 ~ 120                               | 107                                            |
| 120 ~ 130                               | 109                                            |
| 130 ~ 140                               | 110                                            |
| 140 ~ 150                               | 111                                            |
| 150 ~ 160                               | 112                                            |
| 160 ~ 170                               | 113                                            |
| 170 ~ 180                               | 114                                            |
| 180 ~ 190                               | 115                                            |
| 190 ~ 200                               | 116                                            |
| 200 ~ 210                               | 117                                            |
| 210 ~ 220                               | 118                                            |
| 220 ~ 230                               | 119                                            |
| 230 ~ 240                               | 120                                            |
| 240 ~ 250                               | 121                                            |
| 250 ~ 260                               | 122                                            |
| 260 ~ 270                               | 123                                            |
| 270 ~ 280                               | 124                                            |
| 280 ~ 290                               | 125                                            |
| 290 ~ 300                               | 126                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.18 |
| Specific Gravity $d$                                      | 2.98 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |     |     |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |     |     |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h   | i   |
| -80 ~ -60                                    | -1.5                                                            | -1.4 | -1.2 | -1.2 | -1.0 | -0.9 | -0.8 | -0.5 | -0.5 | -0.2 | 0.3 | 1.0 |
| -60 ~ -40                                    | -1.6                                                            | -1.5 | -1.3 | -1.2 | -1.2 | -1.1 | -0.9 | -0.6 | -0.5 | -0.2 | 0.2 | 0.9 |
| -40 ~ -20                                    | -1.6                                                            | -1.5 | -1.3 | -1.2 | -1.2 | -1.1 | -0.9 | -0.6 | -0.5 | -0.2 | 0.2 | 1.0 |
| -20 ~ 0                                      | -1.6                                                            | -1.5 | -1.3 | -1.2 | -1.2 | -1.0 | -0.9 | -0.5 | -0.5 | -0.1 | 0.3 | 1.1 |
| 0 ~ 20                                       | -1.5                                                            | -1.4 | -1.1 | -1.0 | -1.0 | -0.9 | -0.7 | -0.4 | -0.4 | 0.0  | 0.4 | 1.2 |
| 20 ~ 40                                      | -1.5                                                            | -1.4 | -1.0 | -1.0 | -0.9 | -0.8 | -0.7 | -0.4 | -0.3 | 0.1  | 0.5 | 1.3 |
| 40 ~ 60                                      | -1.3                                                            | -1.2 | -1.0 | -0.9 | -0.9 | -0.7 | -0.6 | -0.3 | -0.3 | 0.1  | 0.6 | 1.5 |
| 60 ~ 80                                      | -1.4                                                            | -1.2 | -0.9 | -0.8 | -0.8 | -0.6 | -0.5 | -0.2 | -0.1 | 0.3  | 0.7 | 1.6 |
| 80 ~ 100                                     | -1.3                                                            | -1.2 | -0.9 | -0.8 | -0.7 | -0.6 | -0.4 | -0.1 | 0.0  | 0.4  | 0.8 | 1.7 |
| 100 ~ 120                                    | -1.3                                                            | -1.2 | -0.9 | -0.7 | -0.7 | -0.5 | -0.4 | 0.0  | 0.0  | 0.4  | 0.9 | 1.8 |
| 120 ~ 140                                    | -1.2                                                            | -1.1 | -0.8 | -0.7 | -0.7 | -0.5 | -0.4 | 0.0  | 0.0  | 0.4  | 0.9 | 1.8 |
| 140 ~ 160                                    | -1.3                                                            | -1.1 | -0.9 | -0.8 | -0.7 | -0.6 | -0.4 | -0.1 | 0.0  | 0.4  | 0.9 | 1.8 |
| 160 ~ 180                                    | -1.4                                                            | -1.2 | -0.9 | -0.8 | -0.8 | -0.7 | -0.5 | -0.1 | 0.0  | 0.4  | 0.9 | 1.9 |

OHARA 25-04

S-BAL12

Code(d) 540595  
Code(e) 542592

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.539 96<br>1.539 956 | Abbe Number $\nu_d$ | 59.46 | Dispersion $n_F - n_C$       | 0.009 081 |
| Refractive Index $n_e$ | 1.542 121             | Abbe Number $\nu_e$ | 59.20 | Dispersion $n_{F'} - n_{C'}$ | 0.009 158 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.513 58 |
| $n_{1970}$         | 1.970 09  | 1.518 48 |
| $n_{1530}$         | 1.529 58  | 1.523 70 |
| $n_{1129}$         | 1.128 64  | 1.528 25 |
| $n_t$              | 1.013 98  | 1.529 74 |
| $n_s$              | 0.852 11  | 1.532 30 |
| $n_{A'}$           | 0.768 19  | 1.534 04 |
| $n_F$              | 0.706 52  | 1.535 62 |
| $n_C$              | 0.656 27  | 1.537 19 |
| $n_{C'}$           | 0.643 85  | 1.537 63 |
| $n_{He-Ne}$        | 0.632 8   | 1.538 04 |
| $n_D$              | 0.589 29  | 1.539 88 |
| $n_d$              | 0.587 56  | 1.539 96 |
| $n_e$              | 0.546 07  | 1.542 12 |
| $n_F$              | 0.486 13  | 1.546 27 |
| $n_{F'}$           | 0.479 99  | 1.546 79 |
| $n_{He-Cd}$        | 0.441 57  | 1.550 56 |
| $n_g$              | 0.435 835 | 1.551 22 |
| $n_h$              | 0.404 656 | 1.555 32 |
| $n_i$              | 0.365 015 | 1.562 32 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 7.146 052 58E-01 |
| $A_2$                           | 6.219 932 89E-01 |
| $A_3$                           | 1.225 376 81E+00 |
| $B_1$                           | 3.017 639 13E-03 |
| $B_2$                           | 1.665 054 50E-02 |
| $B_3$                           | 1.435 063 14E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 2.0 |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 71.0  |   |
| Rigidity Modulus G (GPa) | 30.6  |   |
| Poisson's Ratio $\sigma$ | 0.161 |   |
| Knoop Hardness Hk[Class] | 530   | 5 |
| Abrasion Aa              | 112   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.007 456 |
| $n_C - n_{A'}$      | 0.003 156 |
| $n_d - n_C$         | 0.002 762 |
| $n_e - n_C$         | 0.004 927 |
| $n_g - n_d$         | 0.011 260 |
| $n_g - n_F$         | 0.004 941 |
| $n_h - n_g$         | 0.004 105 |
| $n_i - n_g$         | 0.011 107 |
| $n_C - n_t$         | 0.007 896 |
| $n_e - n_{C'}$      | 0.004 487 |
| $n_{F'} - n_e$      | 0.004 671 |
| $n_i - n_{F'}$      | 0.015 531 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.821 1 |
| $\theta_{C,A'}$              | 0.347 5 |
| $\theta_{d,C}$               | 0.304 2 |
| $\theta_{e,C}$               | 0.542 6 |
| $\theta_{g,d}$               | 1.240 0 |
| $\theta_{g,F}$               | 0.544 1 |
| $\theta_{h,g}$               | 0.452 0 |
| $\theta_{i,g}$               | 1.223 1 |
| $\theta'_{C,t}$              | 0.862 2 |
| $\theta'_{e,C'}$             | 0.490 0 |
| $\theta'_{F,e}$              | 0.510 0 |
| $\theta'_{i,F'}$             | 1.695 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.004 6 |
| $\Delta\theta_{C,A'}$ | -0.000 5 |
| $\Delta\theta_{g,d}$  | -0.001 2 |
| $\Delta\theta_{g,F}$  | -0.001 2 |
| $\Delta\theta_{i,g}$  | -0.004 0 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 330  | $\lambda_5$      | 300 |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 330  | $\lambda_{0.05}$ | 301 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.09 | 0.06             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    | 0.02             |
| 310                    | 0.23             |
| 320                    | 0.57             |
| 330                    | 0.80             |
| 340                    | 0.914            |
| 350                    | 0.959            |
| 360                    | 0.979            |
| 370                    | 0.989            |
| 380                    | 0.992            |
| 390                    | 0.995            |
| 400                    | 0.997            |
| 420                    | 0.997            |
| 440                    | 0.997            |
| 460                    | 0.997            |
| 480                    | 0.998            |
| 500                    | 0.999            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.993            |
| 1 600                  | 0.995            |
| 1 800                  | 0.983            |
| 2 000                  | 0.966            |
| 2 200                  | 0.920            |
| 2 400                  | 0.89             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 432   |
| Annealing Point AP (°C)                                          | 468   |
| Transformation Temperature Tg (°C)                               | 483   |
| Yield Point At (°C)                                              | 543   |
| Softening Point SP (°C)                                          | 624   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 84    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 105   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.982 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 68                                             |
| -90 ~ -80                               | 70                                             |
| -80 ~ -70                               | 71                                             |
| -70 ~ -60                               | 73                                             |
| -60 ~ -50                               | 74                                             |
| -50 ~ -40                               | 75                                             |
| -40 ~ -30                               | 77                                             |
| -30 ~ -20                               | 78                                             |
| -20 ~ -10                               | 80                                             |
| -10 ~ 0                                 | 81                                             |
| 0 ~ 10                                  | 82                                             |
| 10 ~ 20                                 | 84                                             |
| 20 ~ 30                                 | 85                                             |
| 30 ~ 40                                 | 86                                             |
| 40 ~ 50                                 | 87                                             |
| 50 ~ 60                                 | 89                                             |
| 60 ~ 70                                 | 90                                             |
| 70 ~ 80                                 | 91                                             |
| 80 ~ 90                                 | 92                                             |
| 90 ~ 100                                | 94                                             |
| 100 ~ 110                               | 95                                             |
| 110 ~ 120                               | 96                                             |
| 120 ~ 130                               | 97                                             |
| 130 ~ 140                               | 98                                             |
| 140 ~ 150                               | 99                                             |
| 150 ~ 160                               | 101                                            |
| 160 ~ 170                               | 102                                            |
| 170 ~ 180                               | 103                                            |
| 180 ~ 190                               | 104                                            |
| 190 ~ 200                               | 105                                            |
| 200 ~ 210                               | 106                                            |
| 210 ~ 220                               | 107                                            |
| 220 ~ 230                               | 108                                            |
| 230 ~ 240                               | 109                                            |
| 240 ~ 250                               | 110                                            |
| 250 ~ 260                               | 111                                            |
| 260 ~ 270                               | 112                                            |
| 270 ~ 280                               | 113                                            |
| 280 ~ 290                               | 114                                            |
| 290 ~ 300                               | 115                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.60 |
| Specific Gravity $d$                                     | 2.75 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 0.7                                                             | 0.8 | 1.1 | 1.2 | 1.2 | 1.3 | 1.4 | 1.6 | 1.6 | 2.0 | 2.2 | 2.7 |
| -60 ~ -40                                    | 0.6                                                             | 0.7 | 1.0 | 1.1 | 1.1 | 1.2 | 1.3 | 1.5 | 1.6 | 1.8 | 2.2 | 2.7 |
| -40 ~ -20                                    | 0.6                                                             | 0.8 | 1.0 | 1.1 | 1.1 | 1.2 | 1.3 | 1.5 | 1.6 | 1.8 | 2.2 | 2.8 |
| -20 ~ 0                                      | 0.6                                                             | 0.8 | 1.0 | 1.1 | 1.1 | 1.2 | 1.4 | 1.6 | 1.6 | 1.9 | 2.2 | 2.9 |
| 0 ~ 20                                       | 0.7                                                             | 0.8 | 1.0 | 1.1 | 1.1 | 1.3 | 1.4 | 1.7 | 1.8 | 2.1 | 2.4 | 3.0 |
| 20 ~ 40                                      | 0.7                                                             | 0.9 | 1.1 | 1.2 | 1.2 | 1.3 | 1.6 | 1.8 | 1.9 | 2.2 | 2.5 | 3.1 |
| 40 ~ 60                                      | 0.9                                                             | 1.0 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.9 | 1.9 | 2.3 | 2.6 | 3.2 |
| 60 ~ 80                                      | 0.9                                                             | 1.0 | 1.3 | 1.3 | 1.4 | 1.5 | 1.8 | 2.0 | 2.1 | 2.4 | 2.8 | 3.4 |
| 80 ~ 100                                     | 0.9                                                             | 1.1 | 1.3 | 1.4 | 1.4 | 1.6 | 1.7 | 2.0 | 2.2 | 2.5 | 2.9 | 3.6 |
| 100 ~ 120                                    | 0.9                                                             | 1.1 | 1.4 | 1.5 | 1.5 | 1.7 | 1.8 | 2.2 | 2.3 | 2.6 | 3.0 | 3.7 |
| 120 ~ 140                                    | 0.9                                                             | 1.1 | 1.5 | 1.6 | 1.6 | 1.8 | 1.9 | 2.2 | 2.3 | 2.7 | 3.0 | 3.8 |
| 140 ~ 160                                    | 1.0                                                             | 1.2 | 1.5 | 1.6 | 1.6 | 1.7 | 1.9 | 2.2 | 2.3 | 2.7 | 3.1 | 3.8 |
| 160 ~ 180                                    | 0.9                                                             | 1.1 | 1.4 | 1.5 | 1.5 | 1.7 | 1.9 | 2.2 | 2.3 | 2.7 | 3.1 | 3.8 |

S-BAL14

Code(d) 569563  
Code(e) 571561

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.568 83<br>1.568 832 | Abbe Number $\nu_d$ | 56.36 | Dispersion $n_F - n_C$       | 0.010 092 |
| Refractive Index $n_e$ | 1.571 237             | Abbe Number $\nu_e$ | 56.09 | Dispersion $n_{F'} - n_{C'}$ | 0.010 185 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.540 50 |
| $n_{1970}$         | 1.970 09  | 1.545 65 |
| $n_{1530}$         | 1.529 58  | 1.551 16 |
| $n_{1129}$         | 1.128 64  | 1.556 01 |
| $n_t$              | 1.013 98  | 1.557 61 |
| $n_s$              | 0.852 11  | 1.560 40 |
| $n_{A'}$           | 0.768 19  | 1.562 30 |
| $n_F$              | 0.706 52  | 1.564 04 |
| $n_C$              | 0.656 27  | 1.565 77 |
| $n_{C'}$           | 0.643 85  | 1.566 26 |
| $n_{He-Ne}$        | 0.632 8   | 1.566 71 |
| $n_D$              | 0.589 29  | 1.568 74 |
| $n_d$              | 0.587 56  | 1.568 83 |
| $n_e$              | 0.546 07  | 1.571 24 |
| $n_F$              | 0.486 13  | 1.575 87 |
| $n_{F'}$           | 0.479 99  | 1.576 45 |
| $n_{He-Cd}$        | 0.441 57  | 1.580 67 |
| $n_g$              | 0.435 835 | 1.581 41 |
| $n_h$              | 0.404 656 | 1.586 04 |
| $n_i$              | 0.365 015 | 1.594 00 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.275 536 96E+00 |
| $A_2$                           | 1.460 833 93E-01 |
| $A_3$                           | 1.167 546 99E+00 |
| $B_1$                           | 7.496 923 59E-03 |
| $B_2$                           | 3.104 215 30E-02 |
| $B_3$                           | 1.289 470 92E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 2   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2~3 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 2.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 81.1  |
| Rigidity Modulus G (GPa) | 32.7  |
| Poisson's Ratio $\sigma$ | 0.240 |
| Knoop Hardness Hk[Class] | 570 6 |
| Abrasion Aa              | 140   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 164 |
| $n_C - n_{A'}$      | 0.003 476 |
| $n_d - n_C$         | 0.003 057 |
| $n_e - n_C$         | 0.005 462 |
| $n_g - n_d$         | 0.012 574 |
| $n_g - n_F$         | 0.005 539 |
| $n_h - n_g$         | 0.004 629 |
| $n_i - n_g$         | 0.012 595 |
| $n_{C'} - n_t$      | 0.008 650 |
| $n_e - n_{C'}$      | 0.004 976 |
| $n_{F'} - n_e$      | 0.005 209 |
| $n_i - n_{F'}$      | 0.017 555 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.809 0 |
| $\theta_{C,A'}$              | 0.344 4 |
| $\theta_{d,C}$               | 0.302 9 |
| $\theta_{e,C}$               | 0.541 2 |
| $\theta_{g,d}$               | 1.245 9 |
| $\theta_{g,F}$               | 0.548 9 |
| $\theta_{h,g}$               | 0.458 7 |
| $\theta_{i,g}$               | 1.248 0 |
| $\theta'_{C,t}$              | 0.849 3 |
| $\theta'_{e,C'}$             | 0.488 6 |
| $\theta'_{F',e}$             | 0.511 4 |
| $\theta'_{i,F'}$             | 1.723 6 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.002 1 |
| $\Delta\theta_{C,A'}$ | 0.000 2  |
| $\Delta\theta_{g,d}$  | -0.001 8 |
| $\Delta\theta_{g,F}$  | -0.001 4 |
| $\Delta\theta_{i,g}$  | -0.005 1 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 360  | $\lambda_5$      | 325 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 354  | $\lambda_{0.05}$ | 329 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.26 | 0.24             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.09             |
| 340                    | 0.44             |
| 350                    | 0.74             |
| 360                    | 0.88             |
| 370                    | 0.946            |
| 380                    | 0.970            |
| 390                    | 0.983            |
| 400                    | 0.989            |
| 420                    | 0.992            |
| 440                    | 0.993            |
| 460                    | 0.994            |
| 480                    | 0.995            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.989            |
| 1 600                  | 0.993            |
| 1 800                  | 0.983            |
| 2 000                  | 0.967            |
| 2 200                  | 0.914            |
| 2 400                  | 0.86             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 533   |
| Annealing Point AP (°C)                                          | 562   |
| Transformation Temperature Tg (°C)                               | 582   |
| Yield Point At (°C)                                              | 640   |
| Softening Point SP (°C)                                          | 700   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 79    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 94    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.967 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 66                                             |
| -90 ~ -80                               | 67                                             |
| -80 ~ -70                               | 68                                             |
| -70 ~ -60                               | 69                                             |
| -60 ~ -50                               | 71                                             |
| -50 ~ -40                               | 72                                             |
| -40 ~ -30                               | 73                                             |
| -30 ~ -20                               | 74                                             |
| -20 ~ -10                               | 75                                             |
| -10 ~ 0                                 | 76                                             |
| 0 ~ 10                                  | 77                                             |
| 10 ~ 20                                 | 78                                             |
| 20 ~ 30                                 | 79                                             |
| 30 ~ 40                                 | 80                                             |
| 40 ~ 50                                 | 81                                             |
| 50 ~ 60                                 | 82                                             |
| 60 ~ 70                                 | 83                                             |
| 70 ~ 80                                 | 84                                             |
| 80 ~ 90                                 | 85                                             |
| 90 ~ 100                                | 86                                             |
| 100 ~ 110                               | 87                                             |
| 110 ~ 120                               | 88                                             |
| 120 ~ 130                               | 89                                             |
| 130 ~ 140                               | 90                                             |
| 140 ~ 150                               | 90                                             |
| 150 ~ 160                               | 91                                             |
| 160 ~ 170                               | 92                                             |
| 170 ~ 180                               | 93                                             |
| 180 ~ 190                               | 94                                             |
| 190 ~ 200                               | 94                                             |
| 200 ~ 210                               | 95                                             |
| 210 ~ 220                               | 96                                             |
| 220 ~ 230                               | 96                                             |
| 230 ~ 240                               | 97                                             |
| 240 ~ 250                               | 98                                             |
| 250 ~ 260                               | 98                                             |
| 260 ~ 270                               | 99                                             |
| 270 ~ 280                               | 100                                            |
| 280 ~ 290                               | 100                                            |
| 290 ~ 300                               | 101                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.32 |
| Specific Gravity $d$                                     | 2.89 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 0.7                                                             | 0.8 | 1.0 | 1.0 | 1.1 | 1.3 | 1.4 | 1.6 | 1.6 | 1.9 | 2.3 | 2.9 |
| -60 ~ -40                                    | 0.6                                                             | 0.7 | 0.9 | 1.0 | 1.0 | 1.1 | 1.2 | 1.6 | 1.6 | 1.9 | 2.2 | 2.8 |
| -40 ~ -20                                    | 0.6                                                             | 0.7 | 0.9 | 0.9 | 1.0 | 1.1 | 1.2 | 1.6 | 1.6 | 1.9 | 2.2 | 2.9 |
| -20 ~ 0                                      | 0.6                                                             | 0.7 | 0.9 | 1.0 | 1.0 | 1.2 | 1.3 | 1.6 | 1.6 | 2.0 | 2.4 | 3.0 |
| 0 ~ 20                                       | 0.6                                                             | 0.7 | 1.0 | 1.2 | 1.2 | 1.3 | 1.5 | 1.7 | 1.8 | 2.1 | 2.4 | 3.1 |
| 20 ~ 40                                      | 0.7                                                             | 0.8 | 1.2 | 1.3 | 1.3 | 1.4 | 1.6 | 1.9 | 1.9 | 2.2 | 2.6 | 3.3 |
| 40 ~ 60                                      | 0.9                                                             | 1.0 | 1.3 | 1.4 | 1.4 | 1.5 | 1.7 | 2.0 | 2.0 | 2.4 | 2.7 | 3.6 |
| 60 ~ 80                                      | 0.9                                                             | 1.2 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 2.1 | 2.2 | 2.6 | 2.9 | 3.7 |
| 80 ~ 100                                     | 1.1                                                             | 1.2 | 1.5 | 1.6 | 1.7 | 1.9 | 2.0 | 2.3 | 2.4 | 2.7 | 3.1 | 3.9 |
| 100 ~ 120                                    | 1.2                                                             | 1.3 | 1.6 | 1.8 | 1.8 | 2.0 | 2.1 | 2.4 | 2.5 | 2.9 | 3.3 | 4.1 |
| 120 ~ 140                                    | 1.3                                                             | 1.5 | 1.8 | 1.9 | 1.9 | 2.1 | 2.2 | 2.6 | 2.6 | 3.0 | 3.4 | 4.2 |
| 140 ~ 160                                    | 1.4                                                             | 1.5 | 1.8 | 1.9 | 2.0 | 2.1 | 2.3 | 2.6 | 2.7 | 3.1 | 3.5 | 4.3 |
| 160 ~ 180                                    | 1.4                                                             | 1.5 | 1.9 | 2.0 | 2.0 | 2.2 | 2.3 | 2.7 | 2.8 | 3.2 | 3.7 | 4.5 |

S-BAL35

Code(d) 589612  
Code(e) 591609

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.589 13<br>1.589 130 | Abbe Number $\nu_d$ | 61.14 | Dispersion $n_F - n_C$       | 0.009 636 |
| Refractive Index $n_e$ | 1.591 429             | Abbe Number $\nu_e$ | 60.88 | Dispersion $n_{F'} - n_{C'}$ | 0.009 714 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.559 59 |
| $n_{1970}$         | 1.970 09  | 1.565 31 |
| $n_{1530}$         | 1.529 58  | 1.571 34 |
| $n_{1129}$         | 1.128 64  | 1.576 48 |
| $n_t$              | 1.013 98  | 1.578 13 |
| $n_s$              | 0.852 11  | 1.580 93 |
| $n_{A'}$           | 0.768 19  | 1.582 80 |
| $n_F$              | 0.706 52  | 1.584 50 |
| $n_C$              | 0.656 27  | 1.586 19 |
| $n_{C'}$           | 0.643 85  | 1.586 66 |
| $n_{He-Ne}$        | 0.632 8   | 1.587 10 |
| $n_D$              | 0.589 29  | 1.589 04 |
| $n_d$              | 0.587 56  | 1.589 13 |
| $n_e$              | 0.546 07  | 1.591 43 |
| $n_F$              | 0.486 13  | 1.595 82 |
| $n_{F'}$           | 0.479 99  | 1.596 37 |
| $n_{He-Cd}$        | 0.441 57  | 1.600 34 |
| $n_g$              | 0.435 835 | 1.601 03 |
| $n_h$              | 0.404 656 | 1.605 35 |
| $n_i$              | 0.365 015 | 1.612 68 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.413 572 73E-01 |
| $A_2$                           | 5.461 748 95E-01 |
| $A_3$                           | 1.161 689 17E+00 |
| $B_1$                           | 1.403 339 96E-02 |
| $B_2$                           | 9.066 356 83E-04 |
| $B_3$                           | 1.141 637 58E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 2   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 2~3 |
| Acid Resistance(Surface) Group SR         | 4,2 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 83.2  |
| Rigidity Modulus G (GPa) | 33.3  |
| Poisson's Ratio $\sigma$ | 0.250 |
| Knoop Hardness Hk[Class] | 590   |
| Abrasion Aa              | 116   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 061 |
| $n_C - n_{A'}$      | 0.003 384 |
| $n_d - n_C$         | 0.002 942 |
| $n_e - n_C$         | 0.005 241 |
| $n_g - n_d$         | 0.011 904 |
| $n_g - n_F$         | 0.005 210 |
| $n_h - n_g$         | 0.004 314 |
| $n_i - n_g$         | 0.011 647 |
| $n_{C'} - n_t$      | 0.008 530 |
| $n_e - n_{C'}$      | 0.004 772 |
| $n_{F'} - n_e$      | 0.004 942 |
| $n_i - n_{F'}$      | 0.016 310 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.836 6 |
| $\theta_{C,A'}$              | 0.351 2 |
| $\theta_{d,C}$               | 0.305 3 |
| $\theta_{e,C}$               | 0.543 9 |
| $\theta_{g,d}$               | 1.235 4 |
| $\theta_{g,F}$               | 0.540 7 |
| $\theta_{h,g}$               | 0.447 7 |
| $\theta_{i,g}$               | 1.208 7 |
| $\theta'_{C,t}$              | 0.878 1 |
| $\theta'_{e,C'}$             | 0.491 2 |
| $\theta'_{F,e}$              | 0.508 8 |
| $\theta'_{i,F'}$             | 1.679 0 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.003 0  |
| $\Delta\theta_{C,A'}$ | 0.001 2  |
| $\Delta\theta_{g,d}$  | -0.002 4 |
| $\Delta\theta_{g,F}$  | -0.001 8 |
| $\Delta\theta_{i,g}$  | -0.004 4 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 345  | $\lambda_5$      | 300 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 339  | $\lambda_{0.05}$ | 303 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.17 | 0.15             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    | 0.01             |
| 310                    | 0.16             |
| 320                    | 0.43             |
| 330                    | 0.67             |
| 340                    | 0.82             |
| 350                    | 0.904            |
| 360                    | 0.949            |
| 370                    | 0.972            |
| 380                    | 0.983            |
| 390                    | 0.989            |
| 400                    | 0.993            |
| 420                    | 0.995            |
| 440                    | 0.995            |
| 460                    | 0.996            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.984            |
| 1 600                  | 0.994            |
| 1 800                  | 0.987            |
| 2 000                  | 0.972            |
| 2 200                  | 0.89             |
| 2 400                  | 0.80             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 619   |
| Annealing Point AP (°C)                                          | 646   |
| Transformation Temperature Tg (°C)                               | 668   |
| Yield Point At (°C)                                              | 715   |
| Softening Point SP (°C)                                          | 768   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 57    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 69    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.915 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 47                                             |
| -90 ~ -80                               | 48                                             |
| -80 ~ -70                               | 49                                             |
| -70 ~ -60                               | 50                                             |
| -60 ~ -50                               | 51                                             |
| -50 ~ -40                               | 52                                             |
| -40 ~ -30                               | 53                                             |
| -30 ~ -20                               | 54                                             |
| -20 ~ -10                               | 55                                             |
| -10 ~ 0                                 | 55                                             |
| 0 ~ 10                                  | 56                                             |
| 10 ~ 20                                 | 57                                             |
| 20 ~ 30                                 | 58                                             |
| 30 ~ 40                                 | 59                                             |
| 40 ~ 50                                 | 60                                             |
| 50 ~ 60                                 | 60                                             |
| 60 ~ 70                                 | 61                                             |
| 70 ~ 80                                 | 62                                             |
| 80 ~ 90                                 | 63                                             |
| 90 ~ 100                                | 63                                             |
| 100 ~ 110                               | 64                                             |
| 110 ~ 120                               | 65                                             |
| 120 ~ 130                               | 65                                             |
| 130 ~ 140                               | 66                                             |
| 140 ~ 150                               | 67                                             |
| 150 ~ 160                               | 67                                             |
| 160 ~ 170                               | 68                                             |
| 170 ~ 180                               | 68                                             |
| 180 ~ 190                               | 69                                             |
| 190 ~ 200                               | 69                                             |
| 200 ~ 210                               | 70                                             |
| 210 ~ 220                               | 70                                             |
| 220 ~ 230                               | 71                                             |
| 230 ~ 240                               | 71                                             |
| 240 ~ 250                               | 71                                             |
| 250 ~ 260                               | 72                                             |
| 260 ~ 270                               | 72                                             |
| 270 ~ 280                               | 72                                             |
| 280 ~ 290                               | 73                                             |
| 290 ~ 300                               | 73                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.15 |
| Specific Gravity $d$                                     | 3.31 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.2                                                             | 2.3 | 2.6 | 2.6 | 2.7 | 2.8 | 2.8 | 3.0 | 3.1 | 3.4 | 3.6 | 4.0 |
| -60 ~ -40                                    | 2.2                                                             | 2.3 | 2.5 | 2.6 | 2.6 | 2.7 | 2.8 | 3.0 | 3.1 | 3.3 | 3.5 | 4.1 |
| -40 ~ -20                                    | 2.2                                                             | 2.3 | 2.5 | 2.6 | 2.6 | 2.8 | 2.9 | 3.1 | 3.1 | 3.4 | 3.6 | 4.1 |
| -20 ~ 0                                      | 2.3                                                             | 2.4 | 2.6 | 2.7 | 2.7 | 2.8 | 3.0 | 3.2 | 3.3 | 3.5 | 3.7 | 4.2 |
| 0 ~ 20                                       | 2.4                                                             | 2.6 | 2.8 | 2.9 | 2.9 | 3.0 | 3.1 | 3.3 | 3.4 | 3.6 | 3.9 | 4.5 |
| 20 ~ 40                                      | 2.6                                                             | 2.8 | 3.0 | 3.0 | 3.1 | 3.2 | 3.3 | 3.5 | 3.5 | 3.8 | 4.1 | 4.7 |
| 40 ~ 60                                      | 2.8                                                             | 2.9 | 3.1 | 3.2 | 3.2 | 3.3 | 3.4 | 3.6 | 3.7 | 3.9 | 4.3 | 4.8 |
| 60 ~ 80                                      | 2.8                                                             | 3.1 | 3.3 | 3.4 | 3.4 | 3.5 | 3.6 | 3.8 | 3.9 | 4.2 | 4.4 | 5.0 |
| 80 ~ 100                                     | 3.0                                                             | 3.1 | 3.4 | 3.5 | 3.5 | 3.7 | 3.8 | 4.0 | 4.1 | 4.3 | 4.6 | 5.2 |
| 100 ~ 120                                    | 3.2                                                             | 3.3 | 3.6 | 3.7 | 3.7 | 3.8 | 3.9 | 4.2 | 4.2 | 4.5 | 4.8 | 5.4 |
| 120 ~ 140                                    | 3.3                                                             | 3.4 | 3.7 | 3.8 | 3.8 | 3.9 | 4.0 | 4.3 | 4.3 | 4.6 | 4.9 | 5.5 |
| 140 ~ 160                                    | 3.4                                                             | 3.5 | 3.7 | 3.8 | 3.8 | 4.0 | 4.1 | 4.4 | 4.4 | 4.7 | 5.0 | 5.7 |
| 160 ~ 180                                    | 3.4                                                             | 3.5 | 3.8 | 4.0 | 4.0 | 4.1 | 4.3 | 4.5 | 4.6 | 4.9 | 5.2 | 5.8 |

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Code(d) 583594  
Code(e) 585591

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.583 13<br>1.583 126 | Abbe Number $\nu_d$ | 59.38 | Dispersion $n_F - n_C$       | 0.009 821 |
| Refractive Index $n_e$ | 1.585 468             | Abbe Number $\nu_e$ | 59.11 | Dispersion $n_{F'} - n_{C'}$ | 0.009 905 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.554 63 |
| $n_{1970}$         | 1.970 09  | 1.559 92 |
| $n_{1530}$         | 1.529 58  | 1.565 57 |
| $n_{1129}$         | 1.128 64  | 1.570 48 |
| $n_t$              | 1.013 98  | 1.572 08 |
| $n_s$              | 0.852 11  | 1.574 85 |
| $n_{A'}$           | 0.768 19  | 1.576 73 |
| $n_F$              | 0.706 52  | 1.578 44 |
| $n_C$              | 0.656 27  | 1.580 14 |
| $n_{C'}$           | 0.643 85  | 1.580 61 |
| $n_{He-Ne}$        | 0.632 8   | 1.581 06 |
| $n_D$              | 0.589 29  | 1.583 04 |
| $n_d$              | 0.587 56  | 1.583 13 |
| $n_e$              | 0.546 07  | 1.585 47 |
| $n_F$              | 0.486 13  | 1.589 96 |
| $n_{F'}$           | 0.479 99  | 1.590 52 |
| $n_{He-Cd}$        | 0.441 57  | 1.594 59 |
| $n_g$              | 0.435 835 | 1.595 30 |
| $n_h$              | 0.404 656 | 1.599 72 |
| $n_i$              | 0.365 015 | 1.607 24 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 1.395 706 15E+00  |
| $A_2$                           | 7.185 050 70E-02  |
| $A_3$                           | 1.271 292 67E+00  |
| $B_1$                           | 1.122 188 43E-02  |
| $B_2$                           | -2.521 174 22E-02 |
| $B_3$                           | 1.344 978 60E+02  |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 2   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.2 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 84.7  |
| Rigidity Modulus G (GPa) | 34.0  |
| Poisson's Ratio σ        | 0.246 |
| Knoop Hardness Hk[Class] | 580 6 |
| Abrasion Aa              | 121   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 056 |
| $n_C - n_{A'}$      | 0.003 413 |
| $n_d - n_C$         | 0.002 987 |
| $n_e - n_C$         | 0.005 329 |
| $n_g - n_d$         | 0.012 171 |
| $n_g - n_F$         | 0.005 337 |
| $n_h - n_g$         | 0.004 424 |
| $n_i - n_g$         | 0.011 946 |
| $n_{C'} - n_t$      | 0.008 531 |
| $n_e - n_{C'}$      | 0.004 854 |
| $n_{F'} - n_e$      | 0.005 051 |
| $n_i - n_{F'}$      | 0.016 724 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.820 3 |
| $\theta_{C,A'}$              | 0.347 5 |
| $\theta_{d,C}$               | 0.304 1 |
| $\theta_{e,C}$               | 0.542 6 |
| $\theta_{g,d}$               | 1.239 3 |
| $\theta_{g,F}$               | 0.543 4 |
| $\theta_{h,g}$               | 0.450 5 |
| $\theta_{i,g}$               | 1.216 4 |
| $\theta'_{C,t}$              | 0.861 3 |
| $\theta'_{e,C'}$             | 0.490 1 |
| $\theta'_{F,e}$              | 0.509 9 |
| $\theta'_{i,F'}$             | 1.688 4 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.005 0 |
| $\Delta\theta_{C,A'}$ | -0.000 4 |
| $\Delta\theta_{g,d}$  | -0.002 1 |
| $\Delta\theta_{g,F}$  | -0.002 0 |
| $\Delta\theta_{i,g}$  | -0.011 4 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 340  | $\lambda_5$      | 290 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 335  | $\lambda_{0.05}$ | 292 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.16 | 0.14             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    | 0.03             |
| 300                    | 0.15             |
| 310                    | 0.36             |
| 320                    | 0.58             |
| 330                    | 0.75             |
| 340                    | 0.86             |
| 350                    | 0.932            |
| 360                    | 0.964            |
| 370                    | 0.979            |
| 380                    | 0.986            |
| 390                    | 0.991            |
| 400                    | 0.993            |
| 420                    | 0.995            |
| 440                    | 0.995            |
| 460                    | 0.996            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.987            |
| 1 600                  | 0.994            |
| 1 800                  | 0.985            |
| 2 000                  | 0.973            |
| 2 200                  | 0.917            |
| 2 400                  | 0.86             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 503   |
| Annealing Point AP (°C)                                          | 534   |
| Transformation Temperature Tg (°C)                               | 553   |
| Yield Point At (°C)                                              | 606   |
| Softening Point SP (°C)                                          | 672   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 67    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 82    |
| Thermal Conductivity λ (W/(m·K))                                 | 0.974 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 54                                             |
| -90 ~ -80                               | 55                                             |
| -80 ~ -70                               | 56                                             |
| -70 ~ -60                               | 57                                             |
| -60 ~ -50                               | 59                                             |
| -50 ~ -40                               | 60                                             |
| -40 ~ -30                               | 61                                             |
| -30 ~ -20                               | 62                                             |
| -20 ~ -10                               | 63                                             |
| -10 ~ 0                                 | 64                                             |
| 0 ~ 10                                  | 66                                             |
| 10 ~ 20                                 | 67                                             |
| 20 ~ 30                                 | 68                                             |
| 30 ~ 40                                 | 69                                             |
| 40 ~ 50                                 | 70                                             |
| 50 ~ 60                                 | 71                                             |
| 60 ~ 70                                 | 72                                             |
| 70 ~ 80                                 | 73                                             |
| 80 ~ 90                                 | 74                                             |
| 90 ~ 100                                | 74                                             |
| 100 ~ 110                               | 75                                             |
| 110 ~ 120                               | 76                                             |
| 120 ~ 130                               | 77                                             |
| 130 ~ 140                               | 78                                             |
| 140 ~ 150                               | 79                                             |
| 150 ~ 160                               | 79                                             |
| 160 ~ 170                               | 80                                             |
| 170 ~ 180                               | 81                                             |
| 180 ~ 190                               | 82                                             |
| 190 ~ 200                               | 82                                             |
| 200 ~ 210                               | 83                                             |
| 210 ~ 220                               | 84                                             |
| 220 ~ 230                               | 84                                             |
| 230 ~ 240                               | 85                                             |
| 240 ~ 250                               | 85                                             |
| 250 ~ 260                               | 86                                             |
| 260 ~ 270                               | 87                                             |
| 270 ~ 280                               | 87                                             |
| 280 ~ 290                               | 88                                             |
| 290 ~ 300                               | 88                                             |

| Other Properties                      |      |
|---------------------------------------|------|
| Photoelastic Constant β nm/(cm·105Pa) | 2.20 |
| Specific Gravity $d$                  | 3.19 |
| Remarks                               |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.2                                                             | 2.3 | 2.5 | 2.7 | 2.7 | 2.8 | 2.9 | 3.1 | 3.1 | 3.4 | 3.8 | 4.3 |
| -60 ~ -40                                    | 2.2                                                             | 2.2 | 2.4 | 2.5 | 2.5 | 2.7 | 2.8 | 3.1 | 3.1 | 3.4 | 3.6 | 4.3 |
| -40 ~ -20                                    | 2.2                                                             | 2.3 | 2.5 | 2.5 | 2.5 | 2.8 | 2.8 | 3.1 | 3.1 | 3.4 | 3.7 | 4.3 |
| -20 ~ 0                                      | 2.2                                                             | 2.3 | 2.5 | 2.6 | 2.6 | 2.7 | 2.8 | 3.2 | 3.2 | 3.5 | 3.8 | 4.4 |
| 0 ~ 20                                       | 2.2                                                             | 2.5 | 2.7 | 2.7 | 2.8 | 2.9 | 3.0 | 3.3 | 3.3 | 3.6 | 3.9 | 4.5 |
| 20 ~ 40                                      | 2.3                                                             | 2.6 | 2.8 | 2.9 | 2.9 | 3.0 | 3.1 | 3.4 | 3.4 | 3.7 | 4.0 | 4.7 |
| 40 ~ 60                                      | 2.5                                                             | 2.6 | 2.9 | 2.9 | 3.0 | 3.1 | 3.2 | 3.5 | 3.5 | 3.8 | 4.3 | 4.9 |
| 60 ~ 80                                      | 2.5                                                             | 2.8 | 3.0 | 3.1 | 3.1 | 3.2 | 3.4 | 3.6 | 3.7 | 4.0 | 4.3 | 5.0 |
| 80 ~ 100                                     | 2.6                                                             | 2.8 | 3.1 | 3.2 | 3.2 | 3.4 | 3.5 | 3.8 | 3.8 | 4.1 | 4.5 | 5.2 |
| 100 ~ 120                                    | 2.7                                                             | 2.9 | 3.2 | 3.3 | 3.3 | 3.4 | 3.6 | 3.9 | 3.9 | 4.3 | 4.6 | 5.3 |
| 120 ~ 140                                    | 2.8                                                             | 3.0 | 3.3 | 3.3 | 3.4 | 3.5 | 3.6 | 3.9 | 4.0 | 4.3 | 4.7 | 5.4 |
| 140 ~ 160                                    | 2.9                                                             | 3.0 | 3.3 | 3.4 | 3.4 | 3.5 | 3.7 | 4.0 | 4.0 | 4.4 | 4.7 | 5.5 |
| 160 ~ 180                                    | 2.8                                                             | 3.0 | 3.3 | 3.4 | 3.4 | 3.5 | 3.8 | 4.1 | 4.1 | 4.5 | 4.8 | 5.6 |

S-BAM 4

Code(d) 606437  
Code(e) 609434

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.605 62<br>1.605 620 | Abbe Number $\nu_d$ | 43.70 | Dispersion $n_F - n_C$       | 0.013 857 |
| Refractive Index $n_e$ | 1.608 909             | Abbe Number $\nu_e$ | 43.41 | Dispersion $n_{F'} - n_{C'}$ | 0.014 026 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.573 51 |
| $n_{1970}$         | 1.970 09  | 1.578 50 |
| $n_{1530}$         | 1.529 58  | 1.584 02 |
| $n_{1129}$         | 1.128 64  | 1.589 26 |
| $n_t$              | 1.013 98  | 1.591 13 |
| $n_s$              | 0.852 11  | 1.594 53 |
| $n_{A'}$           | 0.768 19  | 1.596 95 |
| $n_F$              | 0.706 52  | 1.599 21 |
| $n_C$              | 0.656 27  | 1.601 51 |
| $n_{C'}$           | 0.643 85  | 1.602 15 |
| $n_{He-Ne}$        | 0.632 8   | 1.602 76 |
| $n_D$              | 0.589 29  | 1.605 50 |
| $n_d$              | 0.587 56  | 1.605 62 |
| $n_e$              | 0.546 07  | 1.608 91 |
| $n_F$              | 0.486 13  | 1.615 36 |
| $n_{F'}$           | 0.479 99  | 1.616 18 |
| $n_{He-Cd}$        | 0.441 57  | 1.622 22 |
| $n_g$              | 0.435 835 | 1.623 29 |
| $n_h$              | 0.404 656 | 1.630 10 |
| $n_i$              | 0.365 015 | 1.642 28 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.410 593 17E+00 |
| $A_2$                           | 1.112 013 06E-01 |
| $A_3$                           | 1.341 489 39E+00 |
| $B_1$                           | 9.633 121 92E-03 |
| $B_2$                           | 4.987 782 10E-02 |
| $B_3$                           | 1.522 376 96E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 76.2  |
| Rigidity Modulus G (GPa) | 30.6  |
| Poisson's Ratio $\sigma$ | 0.244 |
| Knoop Hardness Hk[Class] | 530 5 |
| Abrasion Aa              | 159   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 380 |
| $n_C - n_{A'}$      | 0.004 557 |
| $n_d - n_C$         | 0.004 113 |
| $n_e - n_C$         | 0.007 402 |
| $n_g - n_d$         | 0.017 671 |
| $n_g - n_F$         | 0.007 927 |
| $n_h - n_g$         | 0.006 811 |
| $n_i - n_g$         | 0.018 992 |
| $n_{C'} - n_t$      | 0.011 028 |
| $n_e - n_{C'}$      | 0.006 754 |
| $n_{F'} - n_e$      | 0.007 272 |
| $n_i - n_{F'}$      | 0.026 102 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.749 1 |
| $\theta_{C,A'}$              | 0.328 9 |
| $\theta_{d,C}$               | 0.296 8 |
| $\theta_{e,C}$               | 0.534 2 |
| $\theta_{g,d}$               | 1.275 2 |
| $\theta_{g,F}$               | 0.572 1 |
| $\theta_{h,g}$               | 0.491 5 |
| $\theta_{i,g}$               | 1.370 6 |
| $\theta'_{C,t}$              | 0.786 3 |
| $\theta'_{e,C'}$             | 0.481 5 |
| $\theta'_{F',e}$             | 0.518 5 |
| $\theta'_{i,F'}$             | 1.861 0 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.002 6 |
| $\Delta\theta_{C,A'}$ | 0.000 1  |
| $\Delta\theta_{g,d}$  | 0.001 2  |
| $\Delta\theta_{g,F}$  | 0.001 3  |
| $\Delta\theta_{i,g}$  | 0.011 5  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 380  | $\lambda_5$      | 345 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 375  | $\lambda_{0.05}$ | 350 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.69 | 0.65             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.06             |
| 360                    | 0.41             |
| 370                    | 0.72             |
| 380                    | 0.87             |
| 390                    | 0.938            |
| 400                    | 0.965            |
| 420                    | 0.986            |
| 440                    | 0.991            |
| 460                    | 0.991            |
| 480                    | 0.993            |
| 500                    | 0.995            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.995            |
| 1 600                  | 0.994            |
| 1 800                  | 0.980            |
| 2 000                  | 0.962            |
| 2 200                  | 0.919            |
| 2 400                  | 0.89             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 548   |
| Annealing Point AP (°C)                                          | 577   |
| Transformation Temperature Tg (°C)                               | 603   |
| Yield Point At (°C)                                              | 650   |
| Softening Point SP (°C)                                          | 722   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 85    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 101   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.931 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 71                                             |
| -90 ~ -80                               | 73                                             |
| -80 ~ -70                               | 74                                             |
| -70 ~ -60                               | 75                                             |
| -60 ~ -50                               | 76                                             |
| -50 ~ -40                               | 77                                             |
| -40 ~ -30                               | 78                                             |
| -30 ~ -20                               | 79                                             |
| -20 ~ -10                               | 81                                             |
| -10 ~ 0                                 | 82                                             |
| 0 ~ 10                                  | 83                                             |
| 10 ~ 20                                 | 84                                             |
| 20 ~ 30                                 | 85                                             |
| 30 ~ 40                                 | 86                                             |
| 40 ~ 50                                 | 87                                             |
| 50 ~ 60                                 | 88                                             |
| 60 ~ 70                                 | 89                                             |
| 70 ~ 80                                 | 90                                             |
| 80 ~ 90                                 | 91                                             |
| 90 ~ 100                                | 92                                             |
| 100 ~ 110                               | 93                                             |
| 110 ~ 120                               | 94                                             |
| 120 ~ 130                               | 95                                             |
| 130 ~ 140                               | 96                                             |
| 140 ~ 150                               | 96                                             |
| 150 ~ 160                               | 97                                             |
| 160 ~ 170                               | 98                                             |
| 170 ~ 180                               | 99                                             |
| 180 ~ 190                               | 100                                            |
| 190 ~ 200                               | 101                                            |
| 200 ~ 210                               | 102                                            |
| 210 ~ 220                               | 102                                            |
| 220 ~ 230                               | 103                                            |
| 230 ~ 240                               | 104                                            |
| 240 ~ 250                               | 105                                            |
| 250 ~ 260                               | 105                                            |
| 260 ~ 270                               | 106                                            |
| 270 ~ 280                               | 107                                            |
| 280 ~ 290                               | 108                                            |
| 290 ~ 300                               | 108                                            |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 2.41 |
| Specific Gravity $d$                        | 2.91 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 0.1                                                             | 0.3 | 0.6 | 0.7 | 0.7 | 0.9 | 1.0 | 1.5 | 1.5 | 2.0 | 2.5 | 3.7 |
| -60 ~ -40                                    | 0.0                                                             | 0.1 | 0.5 | 0.6 | 0.6 | 0.8 | 1.0 | 1.3 | 1.4 | 2.0 | 2.5 | 3.6 |
| -40 ~ -20                                    | -0.1                                                            | 0.1 | 0.5 | 0.6 | 0.6 | 0.8 | 1.0 | 1.3 | 1.4 | 1.9 | 2.5 | 3.7 |
| -20 ~ 0                                      | 0.0                                                             | 0.1 | 0.4 | 0.6 | 0.7 | 0.9 | 1.0 | 1.4 | 1.5 | 2.0 | 2.6 | 3.9 |
| 0 ~ 20                                       | 0.1                                                             | 0.2 | 0.6 | 0.7 | 0.7 | 0.9 | 1.1 | 1.5 | 1.6 | 2.1 | 2.8 | 4.0 |
| 20 ~ 40                                      | 0.1                                                             | 0.3 | 0.6 | 0.7 | 0.8 | 1.0 | 1.2 | 1.6 | 1.7 | 2.2 | 2.8 | 4.3 |
| 40 ~ 60                                      | 0.2                                                             | 0.3 | 0.7 | 0.8 | 0.8 | 1.1 | 1.3 | 1.8 | 1.9 | 2.5 | 3.1 | 4.4 |
| 60 ~ 80                                      | 0.3                                                             | 0.5 | 0.8 | 1.0 | 1.0 | 1.2 | 1.4 | 1.9 | 2.0 | 2.6 | 3.2 | 4.6 |
| 80 ~ 100                                     | 0.4                                                             | 0.5 | 0.9 | 1.1 | 1.1 | 1.3 | 1.5 | 2.0 | 2.1 | 2.7 | 3.4 | 4.8 |
| 100 ~ 120                                    | 0.4                                                             | 0.6 | 1.0 | 1.1 | 1.2 | 1.4 | 1.6 | 2.1 | 2.2 | 2.8 | 3.5 | 5.0 |
| 120 ~ 140                                    | 0.5                                                             | 0.6 | 1.1 | 1.2 | 1.2 | 1.5 | 1.7 | 2.2 | 2.3 | 2.9 | 3.6 | 5.2 |
| 140 ~ 160                                    | 0.4                                                             | 0.6 | 1.1 | 1.2 | 1.3 | 1.5 | 1.7 | 2.3 | 2.3 | 3.0 | 3.8 | 5.4 |
| 160 ~ 180                                    | 0.4                                                             | 0.6 | 1.1 | 1.3 | 1.3 | 1.6 | 1.8 | 2.4 | 2.5 | 3.1 | 3.9 | 5.5 |

## S-BAM12

Code(d) 639449

Code(e) 643446

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.639 30<br>1.639 300 | Abbe Number $\nu_d$ | 44.87 | Dispersion $n_F - n_C$       | 0.014 247 |
| Refractive Index $n_e$ | 1.642 684             | Abbe Number $\nu_e$ | 44.59 | Dispersion $n_{F'} - n_{C'}$ | 0.014 414 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.604 80 |
| $n_{1970}$         | 1.970 09  | 1.610 40 |
| $n_{1530}$         | 1.529 58  | 1.616 53 |
| $n_{1129}$         | 1.128 64  | 1.622 23 |
| $n_t$              | 1.013 98  | 1.624 22 |
| $n_s$              | 0.852 11  | 1.627 81 |
| $n_{A'}$           | 0.768 19  | 1.630 33 |
| $n_F$              | 0.706 52  | 1.632 68 |
| $n_C$              | 0.656 27  | 1.635 06 |
| $n_{C'}$           | 0.643 85  | 1.635 73 |
| $n_{He-Ne}$        | 0.632 8   | 1.636 35 |
| $n_D$              | 0.589 29  | 1.639 17 |
| $n_d$              | 0.587 56  | 1.639 30 |
| $n_e$              | 0.546 07  | 1.642 68 |
| $n_F$              | 0.486 13  | 1.649 30 |
| $n_{F'}$           | 0.479 99  | 1.650 14 |
| $n_{He-Cd}$        | 0.441 57  | 1.656 31 |
| $n_g$              | 0.435 835 | 1.657 40 |
| $n_h$              | 0.404 656 | 1.664 33 |
| $n_i$              | 0.365 015 | 1.676 65 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.501 616 05E+00 |
| $A_2$                           | 1.269 874 45E-01 |
| $A_3$                           | 1.435 440 52E+00 |
| $B_1$                           | 9.407 618 26E-03 |
| $B_2$                           | 4.726 021 95E-02 |
| $B_3$                           | 1.416 664 99E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 3.2 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 90.4  |
| Rigidity Modulus G (GPa) | 36.1  |
| Poisson's Ratio $\sigma$ | 0.253 |
| Knoop Hardness Hk[Class] | 570 6 |
| Abrasion Aa              | 154   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 836 |
| $n_C - n_{A'}$      | 0.004 725 |
| $n_d - n_C$         | 0.004 243 |
| $n_e - n_C$         | 0.007 627 |
| $n_g - n_d$         | 0.018 101 |
| $n_g - n_F$         | 0.008 097 |
| $n_h - n_g$         | 0.006 929 |
| $n_i - n_g$         | 0.019 244 |
| $n_{C'} - n_t$      | 0.011 505 |
| $n_e - n_{C'}$      | 0.006 958 |
| $n_{F'} - n_e$      | 0.007 456 |
| $n_i - n_{F'}$      | 0.026 505 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.760 6 |
| $\theta_{C,A'}$              | 0.331 6 |
| $\theta_{d,C}$               | 0.297 8 |
| $\theta_{e,C}$               | 0.535 3 |
| $\theta_{g,d}$               | 1.270 5 |
| $\theta_{g,F}$               | 0.568 3 |
| $\theta_{h,g}$               | 0.486 3 |
| $\theta_{i,g}$               | 1.350 7 |
| $\theta'_{C,t}$              | 0.798 2 |
| $\theta'_{e,C'}$             | 0.482 7 |
| $\theta'_{F,e}$              | 0.517 3 |
| $\theta'_{i,F'}$             | 1.838 8 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.003 4  |
| $\Delta\theta_{C,A'}$ | 0.001 4  |
| $\Delta\theta_{g,d}$  | -0.001 0 |
| $\Delta\theta_{g,F}$  | -0.000 6 |
| $\Delta\theta_{i,g}$  | 0.001 4  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 385  | $\lambda_5$      | 345 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 374  | $\lambda_{0.05}$ | 348 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.93 | 0.93             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.13             |
| 360                    | 0.49             |
| 370                    | 0.75             |
| 380                    | 0.87             |
| 390                    | 0.928            |
| 400                    | 0.955            |
| 420                    | 0.977            |
| 440                    | 0.983            |
| 460                    | 0.987            |
| 480                    | 0.990            |
| 500                    | 0.993            |
| 550                    | 0.997            |
| 600                    | 0.996            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.992            |
| 1 600                  | 0.995            |
| 1 800                  | 0.987            |
| 2 000                  | 0.976            |
| 2 200                  | 0.932            |
| 2 400                  | 0.86             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 565   |
| Annealing Point AP (°C)                                          | 592   |
| Transformation Temperature Tg (°C)                               | 605   |
| Yield Point At (°C)                                              | 659   |
| Softening Point SP (°C)                                          | 717   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 76    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 91    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.954 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 63                                             |
| -90 ~ -80                               | 64                                             |
| -80 ~ -70                               | 65                                             |
| -70 ~ -60                               | 66                                             |
| -60 ~ -50                               | 68                                             |
| -50 ~ -40                               | 69                                             |
| -40 ~ -30                               | 70                                             |
| -30 ~ -20                               | 71                                             |
| -20 ~ -10                               | 72                                             |
| -10 ~ 0                                 | 73                                             |
| 0 ~ 10                                  | 74                                             |
| 10 ~ 20                                 | 75                                             |
| 20 ~ 30                                 | 77                                             |
| 30 ~ 40                                 | 78                                             |
| 40 ~ 50                                 | 79                                             |
| 50 ~ 60                                 | 80                                             |
| 60 ~ 70                                 | 80                                             |
| 70 ~ 80                                 | 81                                             |
| 80 ~ 90                                 | 82                                             |
| 90 ~ 100                                | 83                                             |
| 100 ~ 110                               | 84                                             |
| 110 ~ 120                               | 85                                             |
| 120 ~ 130                               | 86                                             |
| 130 ~ 140                               | 87                                             |
| 140 ~ 150                               | 87                                             |
| 150 ~ 160                               | 88                                             |
| 160 ~ 170                               | 89                                             |
| 170 ~ 180                               | 90                                             |
| 180 ~ 190                               | 90                                             |
| 190 ~ 200                               | 91                                             |
| 200 ~ 210                               | 92                                             |
| 210 ~ 220                               | 92                                             |
| 220 ~ 230                               | 93                                             |
| 230 ~ 240                               | 93                                             |
| 240 ~ 250                               | 94                                             |
| 250 ~ 260                               | 94                                             |
| 260 ~ 270                               | 95                                             |
| 270 ~ 280                               | 95                                             |
| 280 ~ 290                               | 96                                             |
| 290 ~ 300                               | 96                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.30 |
| Specific Gravity $d$                                      | 3.18 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.4                                                             | 1.5 | 1.9 | 2.0 | 2.0 | 2.2 | 2.4 | 2.7 | 2.8 | 3.3 | 3.8 | 4.9 |
| -60 ~ -40                                    | 1.3                                                             | 1.5 | 1.8 | 1.9 | 1.9 | 2.1 | 2.2 | 2.7 | 2.8 | 3.2 | 3.7 | 4.9 |
| -40 ~ -20                                    | 1.3                                                             | 1.4 | 1.8 | 1.9 | 1.9 | 2.1 | 2.3 | 2.8 | 2.8 | 3.3 | 3.9 | 5.0 |
| -20 ~ 0                                      | 1.3                                                             | 1.5 | 1.8 | 2.0 | 2.0 | 2.2 | 2.4 | 2.8 | 2.9 | 3.5 | 4.1 | 5.3 |
| 0 ~ 20                                       | 1.3                                                             | 1.5 | 1.9 | 2.0 | 2.1 | 2.3 | 2.5 | 3.0 | 3.1 | 3.6 | 4.2 | 5.5 |
| 20 ~ 40                                      | 1.4                                                             | 1.6 | 2.0 | 2.1 | 2.2 | 2.4 | 2.6 | 3.1 | 3.2 | 3.8 | 4.5 | 5.7 |
| 40 ~ 60                                      | 1.5                                                             | 1.7 | 2.2 | 2.3 | 2.4 | 2.6 | 2.9 | 3.3 | 3.4 | 4.0 | 4.7 | 6.0 |
| 60 ~ 80                                      | 1.7                                                             | 1.9 | 2.3 | 2.4 | 2.5 | 2.7 | 3.0 | 3.5 | 3.5 | 4.2 | 5.0 | 6.4 |
| 80 ~ 100                                     | 1.8                                                             | 2.0 | 2.4 | 2.6 | 2.6 | 2.9 | 3.1 | 3.7 | 3.7 | 4.4 | 5.1 | 6.6 |
| 100 ~ 120                                    | 1.9                                                             | 2.1 | 2.6 | 2.7 | 2.8 | 3.0 | 3.3 | 3.8 | 3.9 | 4.6 | 5.3 | 6.8 |
| 120 ~ 140                                    | 1.9                                                             | 2.2 | 2.7 | 2.8 | 2.9 | 3.1 | 3.4 | 4.0 | 4.1 | 4.8 | 5.5 | 7.1 |
| 140 ~ 160                                    | 2.0                                                             | 2.2 | 2.7 | 2.9 | 2.9 | 3.2 | 3.5 | 4.2 | 4.2 | 5.0 | 5.8 | 7.4 |
| 160 ~ 180                                    | 2.1                                                             | 2.3 | 2.9 | 3.0 | 3.1 | 3.4 | 3.7 | 4.3 | 4.3 | 5.1 | 5.9 | 7.6 |

OHARA 25-04

## S-BSL 7

Code(d) 516641

Code(e) 518639

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.516 33<br>1.516 330 | Abbe Number $\nu_d$ | 64.14 | Dispersion $n_F - n_C$       | 0.008 050 |
| Refractive Index $n_e$ | 1.518 251             | Abbe Number $\nu_e$ | 63.93 | Dispersion $n_{F'} - n_{C'}$ | 0.008 107 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.488 99 |
| $n_{1970}$         | 1.970 09  | 1.494 62 |
| $n_{1530}$         | 1.529 58  | 1.500 50 |
| $n_{1129}$         | 1.128 64  | 1.505 36 |
| $n_t$              | 1.013 98  | 1.506 86 |
| $n_s$              | 0.852 11  | 1.509 35 |
| $n_{A'}$           | 0.768 19  | 1.510 97 |
| $n_F$              | 0.706 52  | 1.512 43 |
| $n_C$              | 0.656 27  | 1.513 86 |
| $n_{C'}$           | 0.643 85  | 1.514 25 |
| $n_{He-Ne}$        | 0.632 8   | 1.514 62 |
| $n_D$              | 0.589 29  | 1.516 26 |
| $n_d$              | 0.587 56  | 1.516 33 |
| $n_e$              | 0.546 07  | 1.518 25 |
| $n_F$              | 0.486 13  | 1.521 91 |
| $n_{F'}$           | 0.479 99  | 1.522 36 |
| $n_{He-Cd}$        | 0.441 57  | 1.525 64 |
| $n_g$              | 0.435 835 | 1.526 21 |
| $n_h$              | 0.404 656 | 1.529 77 |
| $n_i$              | 0.365 015 | 1.535 78 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 1.151 501 90E+00  |
| $A_2$                           | 1.185 836 12E-01  |
| $A_3$                           | 1.263 013 59E+00  |
| $B_1$                           | 1.059 841 30E-02  |
| $B_2$                           | -1.182 251 90E-02 |
| $B_3$                           | 1.296 176 62E+02  |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 2   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 2.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 80.0  |
| Rigidity Modulus G (GPa) | 33.2  |
| Poisson's Ratio $\sigma$ | 0.205 |
| Knoop Hardness Hk[Class] | 570   |
| Abrasion Aa              | 94    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.006 993 |
| $n_C - n_{A'}$      | 0.002 882 |
| $n_d - n_C$         | 0.002 475 |
| $n_e - n_C$         | 0.004 396 |
| $n_g - n_d$         | 0.009 884 |
| $n_g - n_F$         | 0.004 309 |
| $n_h - n_g$         | 0.003 554 |
| $n_i - n_g$         | 0.009 571 |
| $n_{C'} - n_t$      | 0.007 389 |
| $n_e - n_{C'}$      | 0.004 000 |
| $n_{F'} - n_e$      | 0.004 107 |
| $n_i - n_{F'}$      | 0.013 427 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.868 7 |
| $\theta_{C,A'}$              | 0.358 0 |
| $\theta_{d,C}$               | 0.307 5 |
| $\theta_{e,C}$               | 0.546 1 |
| $\theta_{g,d}$               | 1.227 8 |
| $\theta_{g,F}$               | 0.535 3 |
| $\theta_{h,g}$               | 0.441 5 |
| $\theta_{i,g}$               | 1.188 9 |
| $\theta'_{C,t}$              | 0.911 4 |
| $\theta'_{e,C'}$             | 0.493 4 |
| $\theta'_{F,e}$              | 0.506 6 |
| $\theta'_{i,F'}$             | 1.656 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.021 1  |
| $\Delta\theta_{C,A'}$ | 0.004 4  |
| $\Delta\theta_{g,d}$  | -0.003 7 |
| $\Delta\theta_{g,F}$  | -0.002 4 |
| $\Delta\theta_{i,g}$  | 0.001 0  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 320  | $\lambda_5$      | 280 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 315  | $\lambda_{0.05}$ | 278 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.06 | 0.04             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.06             |
| 290                    | 0.25             |
| 300                    | 0.52             |
| 310                    | 0.74             |
| 320                    | 0.87             |
| 330                    | 0.936            |
| 340                    | 0.969            |
| 350                    | 0.984            |
| 360                    | 0.991            |
| 370                    | 0.994            |
| 380                    | 0.995            |
| 390                    | 0.997            |
| 400                    | 0.998            |
| 420                    | 0.998            |
| 440                    | 0.997            |
| 460                    | 0.997            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.973            |
| 1 600                  | 0.989            |
| 1 800                  | 0.968            |
| 2 000                  | 0.933            |
| 2 200                  | 0.82             |
| 2 400                  | 0.77             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 532  |
| Annealing Point AP (°C)                                          | 563  |
| Transformation Temperature Tg (°C)                               | 569  |
| Yield Point At (°C)                                              | 641  |
| Softening Point SP (°C)                                          | 718  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 73   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 89   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.13 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 58                                             |
| -90 ~ -80                               | 59                                             |
| -80 ~ -70                               | 61                                             |
| -70 ~ -60                               | 62                                             |
| -60 ~ -50                               | 64                                             |
| -50 ~ -40                               | 65                                             |
| -40 ~ -30                               | 67                                             |
| -30 ~ -20                               | 68                                             |
| -20 ~ -10                               | 69                                             |
| -10 ~ 0                                 | 70                                             |
| 0 ~ 10                                  | 72                                             |
| 10 ~ 20                                 | 73                                             |
| 20 ~ 30                                 | 74                                             |
| 30 ~ 40                                 | 75                                             |
| 40 ~ 50                                 | 76                                             |
| 50 ~ 60                                 | 77                                             |
| 60 ~ 70                                 | 78                                             |
| 70 ~ 80                                 | 79                                             |
| 80 ~ 90                                 | 80                                             |
| 90 ~ 100                                | 81                                             |
| 100 ~ 110                               | 82                                             |
| 110 ~ 120                               | 83                                             |
| 120 ~ 130                               | 84                                             |
| 130 ~ 140                               | 85                                             |
| 140 ~ 150                               | 85                                             |
| 150 ~ 160                               | 86                                             |
| 160 ~ 170                               | 87                                             |
| 170 ~ 180                               | 88                                             |
| 180 ~ 190                               | 88                                             |
| 190 ~ 200                               | 89                                             |
| 200 ~ 210                               | 89                                             |
| 210 ~ 220                               | 90                                             |
| 220 ~ 230                               | 90                                             |
| 230 ~ 240                               | 91                                             |
| 240 ~ 250                               | 91                                             |
| 250 ~ 260                               | 92                                             |
| 260 ~ 270                               | 92                                             |
| 270 ~ 280                               | 93                                             |
| 280 ~ 290                               | 93                                             |
| 290 ~ 300                               | 93                                             |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 2.79 |
| Specific Gravity $d$                        | 2.52 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.7                                                             | 1.8 | 1.9 | 2.0 | 2.0 | 2.1 | 2.2 | 2.4 | 2.4 | 2.6 | 2.8 | 3.3 |
| -60 ~ -40                                    | 1.6                                                             | 1.7 | 1.8 | 1.9 | 1.9 | 1.9 | 2.1 | 2.3 | 2.3 | 2.5 | 2.7 | 3.1 |
| -40 ~ -20                                    | 1.5                                                             | 1.6 | 1.8 | 1.8 | 1.9 | 2.0 | 2.1 | 2.3 | 2.3 | 2.5 | 2.7 | 3.2 |
| -20 ~ 0                                      | 1.6                                                             | 1.6 | 1.8 | 2.0 | 2.0 | 2.1 | 2.2 | 2.4 | 2.4 | 2.6 | 2.8 | 3.3 |
| 0 ~ 20                                       | 1.7                                                             | 1.8 | 1.9 | 2.0 | 2.0 | 2.1 | 2.2 | 2.4 | 2.4 | 2.7 | 3.0 | 3.5 |
| 20 ~ 40                                      | 1.8                                                             | 1.8 | 2.0 | 2.1 | 2.1 | 2.2 | 2.3 | 2.5 | 2.6 | 2.8 | 3.2 | 3.7 |
| 40 ~ 60                                      | 1.8                                                             | 1.9 | 2.2 | 2.3 | 2.3 | 2.4 | 2.5 | 2.8 | 2.8 | 3.1 | 3.3 | 3.9 |
| 60 ~ 80                                      | 2.0                                                             | 2.1 | 2.3 | 2.4 | 2.4 | 2.5 | 2.6 | 2.9 | 3.0 | 3.3 | 3.6 | 4.1 |
| 80 ~ 100                                     | 2.1                                                             | 2.2 | 2.4 | 2.5 | 2.5 | 2.7 | 2.8 | 3.0 | 3.1 | 3.4 | 3.7 | 4.3 |
| 100 ~ 120                                    | 2.2                                                             | 2.4 | 2.6 | 2.7 | 2.7 | 2.8 | 2.9 | 3.2 | 3.2 | 3.5 | 4.0 | 4.6 |
| 120 ~ 140                                    | 2.3                                                             | 2.5 | 2.7 | 2.8 | 2.8 | 2.9 | 3.1 | 3.4 | 3.5 | 3.8 | 4.1 | 4.8 |
| 140 ~ 160                                    | 2.5                                                             | 2.7 | 2.9 | 3.0 | 3.0 | 3.2 | 3.3 | 3.6 | 3.6 | 3.9 | 4.3 | 4.9 |
| 160 ~ 180                                    | 2.6                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.2 | 3.4 | 3.7 | 3.7 | 4.1 | 4.4 | 5.1 |

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S-BSM 2

Code(d) 607568  
Code(e) 610565

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.607 38<br>1.607 379 | Abbe Number $\nu_d$ | 56.81 | Dispersion $n_F - n_C$       | 0.010 691 |
| Refractive Index $n_e$ | 1.609 927             | Abbe Number $\nu_e$ | 56.53 | Dispersion $n_{F'} - n_{C'}$ | 0.010 790 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.578 74 |
| $n_{1970}$         | 1.970 09  | 1.583 74 |
| $n_{1530}$         | 1.529 58  | 1.589 13 |
| $n_{1129}$         | 1.128 64  | 1.593 98 |
| $n_t$              | 1.013 98  | 1.595 61 |
| $n_s$              | 0.852 11  | 1.598 49 |
| $n_{A'}$           | 0.768 19  | 1.600 48 |
| $n_F$              | 0.706 52  | 1.602 31 |
| $n_C$              | 0.656 27  | 1.604 14 |
| $n_{C'}$           | 0.643 85  | 1.604 66 |
| $n_{He-Ne}$        | 0.632 8   | 1.605 14 |
| $n_D$              | 0.589 29  | 1.607 28 |
| $n_d$              | 0.587 56  | 1.607 38 |
| $n_e$              | 0.546 07  | 1.609 93 |
| $n_F$              | 0.486 13  | 1.614 83 |
| $n_{F'}$           | 0.479 99  | 1.615 45 |
| $n_{He-Cd}$        | 0.441 57  | 1.619 92 |
| $n_g$              | 0.435 835 | 1.620 70 |
| $n_h$              | 0.404 656 | 1.625 58 |
| $n_i$              | 0.365 015 | 1.633 94 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 8.671 686 76E-01 |
| $A_2$                           | 6.728 483 43E-01 |
| $A_3$                           | 1.184 561 07E+00 |
| $B_1$                           | 3.693 110 03E-03 |
| $B_2$                           | 1.816 528 04E-02 |
| $B_3$                           | 1.323 761 47E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 5,2 |
| Phosphate Resistance PR                   | 2,2 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 78.0  |
| Rigidity Modulus G (GPa) | 30.9  |
| Poisson's Ratio $\sigma$ | 0.264 |
| Knoop Hardness Hk[Class] | 550 6 |
| Abrasion Aa              | 139   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 534 |
| $n_C - n_{A'}$      | 0.003 662 |
| $n_d - n_C$         | 0.003 235 |
| $n_e - n_C$         | 0.005 783 |
| $n_g - n_d$         | 0.013 318 |
| $n_g - n_F$         | 0.005 862 |
| $n_h - n_g$         | 0.004 885 |
| $n_i - n_g$         | 0.013 244 |
| $n_{C'} - n_t$      | 0.009 048 |
| $n_e - n_{C'}$      | 0.005 269 |
| $n_{F'} - n_e$      | 0.005 521 |
| $n_i - n_{F'}$      | 0.018 493 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.798 2 |
| $\theta_{C,A'}$              | 0.342 5 |
| $\theta_{d,C}$               | 0.302 6 |
| $\theta_{e,C}$               | 0.540 9 |
| $\theta_{g,d}$               | 1.245 7 |
| $\theta_{g,F}$               | 0.548 3 |
| $\theta_{h,g}$               | 0.456 9 |
| $\theta_{i,g}$               | 1.238 8 |
| $\theta'_{C,t}$              | 0.838 6 |
| $\theta'_{e,C'}$             | 0.488 3 |
| $\theta'_{F,e}$              | 0.511 7 |
| $\theta'_{i,F'}$             | 1.713 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.015 0 |
| $\Delta\theta_{C,A'}$ | -0.002 2 |
| $\Delta\theta_{g,d}$  | -0.001 0 |
| $\Delta\theta_{g,F}$  | -0.001 3 |
| $\Delta\theta_{i,g}$  | -0.010 5 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 350  | $\lambda_5$      | 300 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 343  | $\lambda_{0.05}$ | 310 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.26 | 0.25             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.04             |
| 320                    | 0.27             |
| 330                    | 0.57             |
| 340                    | 0.77             |
| 350                    | 0.88             |
| 360                    | 0.941            |
| 370                    | 0.967            |
| 380                    | 0.981            |
| 390                    | 0.987            |
| 400                    | 0.991            |
| 420                    | 0.991            |
| 440                    | 0.990            |
| 460                    | 0.991            |
| 480                    | 0.993            |
| 500                    | 0.995            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.996            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.994            |
| 1 600                  | 0.997            |
| 1 800                  | 0.992            |
| 2 000                  | 0.984            |
| 2 200                  | 0.951            |
| 2 400                  | 0.89             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 612   |
| Annealing Point AP (°C)                                          | 643   |
| Transformation Temperature Tg (°C)                               | 659   |
| Yield Point At (°C)                                              | 716   |
| Softening Point SP (°C)                                          | 778   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 64    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 76    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.802 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 52                                             |
| -90 ~ -80                               | 54                                             |
| -80 ~ -70                               | 55                                             |
| -70 ~ -60                               | 56                                             |
| -60 ~ -50                               | 57                                             |
| -50 ~ -40                               | 58                                             |
| -40 ~ -30                               | 59                                             |
| -30 ~ -20                               | 60                                             |
| -20 ~ -10                               | 60                                             |
| -10 ~ 0                                 | 61                                             |
| 0 ~ 10                                  | 62                                             |
| 10 ~ 20                                 | 63                                             |
| 20 ~ 30                                 | 64                                             |
| 30 ~ 40                                 | 65                                             |
| 40 ~ 50                                 | 66                                             |
| 50 ~ 60                                 | 66                                             |
| 60 ~ 70                                 | 67                                             |
| 70 ~ 80                                 | 68                                             |
| 80 ~ 90                                 | 69                                             |
| 90 ~ 100                                | 70                                             |
| 100 ~ 110                               | 70                                             |
| 110 ~ 120                               | 71                                             |
| 120 ~ 130                               | 72                                             |
| 130 ~ 140                               | 72                                             |
| 140 ~ 150                               | 73                                             |
| 150 ~ 160                               | 74                                             |
| 160 ~ 170                               | 74                                             |
| 170 ~ 180                               | 75                                             |
| 180 ~ 190                               | 75                                             |
| 190 ~ 200                               | 76                                             |
| 200 ~ 210                               | 76                                             |
| 210 ~ 220                               | 77                                             |
| 220 ~ 230                               | 77                                             |
| 230 ~ 240                               | 78                                             |
| 240 ~ 250                               | 78                                             |
| 250 ~ 260                               | 79                                             |
| 260 ~ 270                               | 79                                             |
| 270 ~ 280                               | 80                                             |
| 280 ~ 290                               | 80                                             |
| 290 ~ 300                               | 80                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.26 |
| Specific Gravity $d$                                     | 3.53 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.5                                                             | 2.7 | 2.9 | 3.0 | 3.0 | 3.1 | 3.2 | 3.6 | 3.6 | 3.9 | 4.2 | 4.8 |
| -60 ~ -40                                    | 2.4                                                             | 2.5 | 2.9 | 2.9 | 3.0 | 3.1 | 3.2 | 3.4 | 3.5 | 3.9 | 4.2 | 4.8 |
| -40 ~ -20                                    | 2.4                                                             | 2.5 | 2.9 | 3.0 | 3.0 | 3.1 | 3.2 | 3.5 | 3.5 | 3.8 | 4.3 | 4.9 |
| -20 ~ 0                                      | 2.5                                                             | 2.6 | 3.0 | 3.1 | 3.1 | 3.2 | 3.3 | 3.6 | 3.6 | 4.0 | 4.3 | 5.0 |
| 0 ~ 20                                       | 2.6                                                             | 2.8 | 3.0 | 3.1 | 3.1 | 3.3 | 3.4 | 3.7 | 3.7 | 4.1 | 4.5 | 5.2 |
| 20 ~ 40                                      | 2.8                                                             | 2.9 | 3.2 | 3.3 | 3.3 | 3.4 | 3.6 | 3.8 | 3.9 | 4.2 | 4.6 | 5.4 |
| 40 ~ 60                                      | 2.8                                                             | 3.0 | 3.3 | 3.4 | 3.4 | 3.5 | 3.7 | 4.1 | 4.1 | 4.5 | 4.8 | 5.5 |
| 60 ~ 80                                      | 3.0                                                             | 3.1 | 3.4 | 3.5 | 3.6 | 3.7 | 3.9 | 4.2 | 4.2 | 4.6 | 4.9 | 5.6 |
| 80 ~ 100                                     | 3.1                                                             | 3.3 | 3.6 | 3.7 | 3.7 | 3.8 | 4.0 | 4.3 | 4.4 | 4.7 | 5.1 | 5.9 |
| 100 ~ 120                                    | 3.2                                                             | 3.4 | 3.7 | 3.8 | 3.8 | 4.0 | 4.1 | 4.5 | 4.5 | 4.9 | 5.3 | 6.0 |
| 120 ~ 140                                    | 3.3                                                             | 3.4 | 3.8 | 3.9 | 3.9 | 4.1 | 4.2 | 4.6 | 4.6 | 5.0 | 5.4 | 6.2 |
| 140 ~ 160                                    | 3.3                                                             | 3.5 | 3.8 | 3.9 | 3.9 | 4.1 | 4.3 | 4.6 | 4.7 | 5.1 | 5.5 | 6.4 |
| 160 ~ 180                                    | 3.3                                                             | 3.5 | 3.8 | 4.0 | 4.1 | 4.2 | 4.4 | 4.8 | 4.8 | 5.2 | 5.6 | 6.5 |

## S-BSM10

Code(d) 623570

Code(e) 625568

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.622 80<br>1.622 799 | Abbe Number $\nu_d$ | 57.05 | Dispersion $n_F - n_C$       | 0.010 916 |
| Refractive Index $n_e$ | 1.625 401             | Abbe Number $\nu_e$ | 56.78 | Dispersion $n_{F'} - n_{C'}$ | 0.011 014 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.592 71 |
| $n_{1970}$         | 1.970 09  | 1.598 09 |
| $n_{1530}$         | 1.529 58  | 1.603 86 |
| $n_{1129}$         | 1.128 64  | 1.608 98 |
| $n_t$              | 1.013 98  | 1.610 69 |
| $n_s$              | 0.852 11  | 1.613 68 |
| $n_{A'}$           | 0.768 19  | 1.615 73 |
| $n_F$              | 0.706 52  | 1.617 61 |
| $n_C$              | 0.656 27  | 1.619 49 |
| $n_{C'}$           | 0.643 85  | 1.620 01 |
| $n_{He-Ne}$        | 0.632 8   | 1.620 51 |
| $n_D$              | 0.589 29  | 1.622 70 |
| $n_d$              | 0.587 56  | 1.622 80 |
| $n_e$              | 0.546 07  | 1.625 40 |
| $n_F$              | 0.486 13  | 1.630 41 |
| $n_{F'}$           | 0.479 99  | 1.631 03 |
| $n_{He-Cd}$        | 0.441 57  | 1.635 58 |
| $n_g$              | 0.435 835 | 1.636 37 |
| $n_h$              | 0.404 656 | 1.641 33 |
| $n_i$              | 0.365 015 | 1.649 80 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.454 430 81E-01 |
| $A_2$                           | 6.432 373 76E-01 |
| $A_3$                           | 1.177 529 68E+00 |
| $B_1$                           | 1.572 637 98E-02 |
| $B_2$                           | 1.619 240 66E-03 |
| $B_3$                           | 1.213 617 48E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 1.0  |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 83.5    |
| Rigidity Modulus G (GPa) | 33.0    |
| Poisson's Ratio $\sigma$ | 0.266   |
| Knoop Hardness Hk[Class] | 570   6 |
| Abrasion Aa              | 134     |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 800 |
| $n_C - n_{A'}$      | 0.003 759 |
| $n_d - n_C$         | 0.003 310 |
| $n_e - n_C$         | 0.005 912 |
| $n_g - n_d$         | 0.013 570 |
| $n_g - n_F$         | 0.005 964 |
| $n_h - n_g$         | 0.004 960 |
| $n_i - n_g$         | 0.013 428 |
| $n_{C'} - n_t$      | 0.009 326 |
| $n_e - n_{C'}$      | 0.005 386 |
| $n_{F'} - n_e$      | 0.005 628 |
| $n_i - n_{F'}$      | 0.018 768 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.806 2 |
| $\theta_{C,A'}$              | 0.344 4 |
| $\theta_{d,C}$               | 0.303 2 |
| $\theta_{e,C}$               | 0.541 6 |
| $\theta_{g,d}$               | 1.243 1 |
| $\theta_{g,F}$               | 0.546 4 |
| $\theta_{h,g}$               | 0.454 4 |
| $\theta_{i,g}$               | 1.230 1 |
| $\theta'_{C,t}$              | 0.846 7 |
| $\theta'_{e,C'}$             | 0.489 0 |
| $\theta'_{F',e}$             | 0.511 0 |
| $\theta'_{i,F'}$             | 1.704 0 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.008 2 |
| $\Delta\theta_{C,A'}$ | -0.000 6 |
| $\Delta\theta_{g,d}$  | -0.003 1 |
| $\Delta\theta_{g,F}$  | -0.002 8 |
| $\Delta\theta_{i,g}$  | -0.017 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 350  | $\lambda_5$      | 305 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 345  | $\lambda_{0.05}$ | 309 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.17 | 0.15             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.08             |
| 320                    | 0.31             |
| 330                    | 0.57             |
| 340                    | 0.75             |
| 350                    | 0.86             |
| 360                    | 0.929            |
| 370                    | 0.962            |
| 380                    | 0.977            |
| 390                    | 0.986            |
| 400                    | 0.991            |
| 420                    | 0.994            |
| 440                    | 0.995            |
| 460                    | 0.996            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.990            |
| 1 600                  | 0.993            |
| 1 800                  | 0.985            |
| 2 000                  | 0.971            |
| 2 200                  | 0.913            |
| 2 400                  | 0.82             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 622   |
| Annealing Point AP (°C)                                          | 650   |
| Transformation Temperature Tg (°C)                               | 674   |
| Yield Point At (°C)                                              | 724   |
| Softening Point SP (°C)                                          | 773   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 65    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 77    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.822 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 54                                             |
| -90 ~ -80                               | 55                                             |
| -80 ~ -70                               | 56                                             |
| -70 ~ -60                               | 57                                             |
| -60 ~ -50                               | 58                                             |
| -50 ~ -40                               | 59                                             |
| -40 ~ -30                               | 60                                             |
| -30 ~ -20                               | 61                                             |
| -20 ~ -10                               | 62                                             |
| -10 ~ 0                                 | 63                                             |
| 0 ~ 10                                  | 64                                             |
| 10 ~ 20                                 | 65                                             |
| 20 ~ 30                                 | 66                                             |
| 30 ~ 40                                 | 66                                             |
| 40 ~ 50                                 | 67                                             |
| 50 ~ 60                                 | 68                                             |
| 60 ~ 70                                 | 69                                             |
| 70 ~ 80                                 | 70                                             |
| 80 ~ 90                                 | 70                                             |
| 90 ~ 100                                | 71                                             |
| 100 ~ 110                               | 72                                             |
| 110 ~ 120                               | 73                                             |
| 120 ~ 130                               | 73                                             |
| 130 ~ 140                               | 74                                             |
| 140 ~ 150                               | 74                                             |
| 150 ~ 160                               | 75                                             |
| 160 ~ 170                               | 76                                             |
| 170 ~ 180                               | 76                                             |
| 180 ~ 190                               | 77                                             |
| 190 ~ 200                               | 77                                             |
| 200 ~ 210                               | 78                                             |
| 210 ~ 220                               | 78                                             |
| 220 ~ 230                               | 78                                             |
| 230 ~ 240                               | 79                                             |
| 240 ~ 250                               | 79                                             |
| 250 ~ 260                               | 80                                             |
| 260 ~ 270                               | 80                                             |
| 270 ~ 280                               | 80                                             |
| 280 ~ 290                               | 81                                             |
| 290 ~ 300                               | 81                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.88 |
| Specific Gravity $d$                                     | 3.60 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.5                                                             | 1.6 | 1.8 | 1.9 | 1.9 | 2.2 | 2.3 | 2.5 | 2.5 | 2.8 | 3.1 | 3.6 |
| -60 ~ -40                                    | 1.3                                                             | 1.5 | 1.8 | 1.8 | 1.9 | 2.0 | 2.1 | 2.3 | 2.4 | 2.7 | 3.0 | 3.5 |
| -40 ~ -20                                    | 1.3                                                             | 1.5 | 1.7 | 1.8 | 1.8 | 2.0 | 2.1 | 2.3 | 2.4 | 2.8 | 3.0 | 3.5 |
| -20 ~ 0                                      | 1.3                                                             | 1.5 | 1.8 | 1.9 | 1.9 | 2.0 | 2.2 | 2.4 | 2.5 | 2.8 | 3.1 | 3.7 |
| 0 ~ 20                                       | 1.5                                                             | 1.6 | 1.9 | 1.9 | 2.0 | 2.1 | 2.2 | 2.5 | 2.5 | 3.0 | 3.3 | 3.8 |
| 20 ~ 40                                      | 1.6                                                             | 1.7 | 2.0 | 2.1 | 2.1 | 2.2 | 2.4 | 2.7 | 2.7 | 3.0 | 3.4 | 4.0 |
| 40 ~ 60                                      | 1.6                                                             | 1.8 | 2.1 | 2.2 | 2.2 | 2.4 | 2.6 | 2.9 | 2.9 | 3.3 | 3.6 | 4.2 |
| 60 ~ 80                                      | 1.8                                                             | 2.0 | 2.3 | 2.4 | 2.4 | 2.5 | 2.7 | 3.0 | 3.0 | 3.4 | 3.7 | 4.4 |
| 80 ~ 100                                     | 1.9                                                             | 2.1 | 2.4 | 2.5 | 2.5 | 2.7 | 2.9 | 3.2 | 3.2 | 3.6 | 3.9 | 4.6 |
| 100 ~ 120                                    | 2.1                                                             | 2.2 | 2.5 | 2.7 | 2.7 | 2.8 | 3.0 | 3.3 | 3.4 | 3.7 | 4.1 | 4.8 |
| 120 ~ 140                                    | 2.1                                                             | 2.3 | 2.6 | 2.8 | 2.8 | 3.0 | 3.1 | 3.5 | 3.5 | 3.9 | 4.3 | 4.9 |
| 140 ~ 160                                    | 2.2                                                             | 2.4 | 2.7 | 2.9 | 2.9 | 3.1 | 3.2 | 3.6 | 3.6 | 4.0 | 4.5 | 5.2 |
| 160 ~ 180                                    | 2.3                                                             | 2.6 | 2.8 | 3.0 | 3.1 | 3.2 | 3.4 | 3.8 | 3.8 | 4.2 | 4.6 | 5.3 |

OHARA 25-04

## S-BSM14

Code(d) 603607  
Code(e) 605604

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.603 11<br>1.603 112 | Abbe Number $\nu_d$ | 60.64 | Dispersion $n_F - n_C$       | 0.009 945 |
| Refractive Index $n_e$ | 1.605 484             | Abbe Number $\nu_e$ | 60.39 | Dispersion $n_{F'} - n_{C'}$ | 0.010 027 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.573 00 |
| $n_{1970}$         | 1.970 09  | 1.578 80 |
| $n_{1530}$         | 1.529 58  | 1.584 91 |
| $n_{1129}$         | 1.128 64  | 1.590 13 |
| $n_t$              | 1.013 98  | 1.591 80 |
| $n_s$              | 0.852 11  | 1.594 67 |
| $n_{A'}$           | 0.768 19  | 1.596 60 |
| $n_F$              | 0.706 52  | 1.598 35 |
| $n_C$              | 0.656 27  | 1.600 08 |
| $n_{C'}$           | 0.643 85  | 1.600 56 |
| $n_{He-Ne}$        | 0.632 8   | 1.601 01 |
| $n_D$              | 0.589 29  | 1.603 02 |
| $n_d$              | 0.587 56  | 1.603 11 |
| $n_e$              | 0.546 07  | 1.605 48 |
| $n_F$              | 0.486 13  | 1.610 02 |
| $n_{F'}$           | 0.479 99  | 1.610 59 |
| $n_{He-Cd}$        | 0.441 57  | 1.614 70 |
| $n_g$              | 0.435 835 | 1.615 41 |
| $n_h$              | 0.404 656 | 1.619 87 |
| $n_i$              | 0.365 015 | 1.627 45 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 1.282 862 70E+00  |
| $A_2$                           | 2.476 474 29E-01  |
| $A_3$                           | 1.103 839 99E+00  |
| $B_1$                           | 1.229 023 99E-02  |
| $B_2$                           | -6.131 423 61E-03 |
| $B_3$                           | 1.068 833 78E+02  |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 2.2  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 84.9  |
| Rigidity Modulus G (GPa) | 33.8  |
| Poisson's Ratio $\sigma$ | 0.257 |
| Knoop Hardness Hk[Class] | 580 6 |
| Abrasion Aa              | 126   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 275 |
| $n_C - n_{A'}$      | 0.003 482 |
| $n_d - n_C$         | 0.003 033 |
| $n_e - n_C$         | 0.005 405 |
| $n_g - n_d$         | 0.012 297 |
| $n_g - n_F$         | 0.005 385 |
| $n_h - n_g$         | 0.004 461 |
| $n_i - n_g$         | 0.012 043 |
| $n_{C'} - n_t$      | 0.008 758 |
| $n_e - n_{C'}$      | 0.004 922 |
| $n_{F'} - n_e$      | 0.005 105 |
| $n_i - n_{F'}$      | 0.016 863 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.832 1 |
| $\theta_{C,A'}$              | 0.350 1 |
| $\theta_{d,C}$               | 0.305 0 |
| $\theta_{e,C}$               | 0.543 5 |
| $\theta_{g,d}$               | 1.236 5 |
| $\theta_{g,F}$               | 0.541 5 |
| $\theta_{h,g}$               | 0.448 6 |
| $\theta_{i,g}$               | 1.211 0 |
| $\theta'_{C,t}$              | 0.873 4 |
| $\theta'_{e,C'}$             | 0.490 9 |
| $\theta'_{F,e}$              | 0.509 1 |
| $\theta'_{i,F'}$             | 1.681 8 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.000 9  |
| $\Delta\theta_{C,A'}$ | 0.000 7  |
| $\Delta\theta_{g,d}$  | -0.002 3 |
| $\Delta\theta_{g,F}$  | -0.001 9 |
| $\Delta\theta_{i,g}$  | -0.006 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 350  | $\lambda_5$      | 295 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 339  | $\lambda_{0.05}$ | 306 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.19 | 0.20             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.17             |
| 320                    | 0.45             |
| 330                    | 0.68             |
| 340                    | 0.82             |
| 350                    | 0.906            |
| 360                    | 0.948            |
| 370                    | 0.968            |
| 380                    | 0.980            |
| 390                    | 0.987            |
| 400                    | 0.991            |
| 420                    | 0.994            |
| 440                    | 0.994            |
| 460                    | 0.995            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.990            |
| 1 600                  | 0.995            |
| 1 800                  | 0.988            |
| 2 000                  | 0.976            |
| 2 200                  | 0.919            |
| 2 400                  | 0.81             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 614   |
| Annealing Point AP (°C)                                          | 641   |
| Transformation Temperature Tg (°C)                               | 661   |
| Yield Point At (°C)                                              | 704   |
| Softening Point SP (°C)                                          | 757   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 61    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 73    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.891 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 50                                             |
| -90 ~ -80                               | 51                                             |
| -80 ~ -70                               | 52                                             |
| -70 ~ -60                               | 53                                             |
| -60 ~ -50                               | 54                                             |
| -50 ~ -40                               | 55                                             |
| -40 ~ -30                               | 56                                             |
| -30 ~ -20                               | 57                                             |
| -20 ~ -10                               | 58                                             |
| -10 ~ 0                                 | 59                                             |
| 0 ~ 10                                  | 60                                             |
| 10 ~ 20                                 | 61                                             |
| 20 ~ 30                                 | 61                                             |
| 30 ~ 40                                 | 62                                             |
| 40 ~ 50                                 | 63                                             |
| 50 ~ 60                                 | 64                                             |
| 60 ~ 70                                 | 65                                             |
| 70 ~ 80                                 | 66                                             |
| 80 ~ 90                                 | 66                                             |
| 90 ~ 100                                | 67                                             |
| 100 ~ 110                               | 68                                             |
| 110 ~ 120                               | 68                                             |
| 120 ~ 130                               | 69                                             |
| 130 ~ 140                               | 70                                             |
| 140 ~ 150                               | 70                                             |
| 150 ~ 160                               | 71                                             |
| 160 ~ 170                               | 71                                             |
| 170 ~ 180                               | 72                                             |
| 180 ~ 190                               | 73                                             |
| 190 ~ 200                               | 73                                             |
| 200 ~ 210                               | 74                                             |
| 210 ~ 220                               | 74                                             |
| 220 ~ 230                               | 75                                             |
| 230 ~ 240                               | 75                                             |
| 240 ~ 250                               | 75                                             |
| 250 ~ 260                               | 76                                             |
| 260 ~ 270                               | 76                                             |
| 270 ~ 280                               | 77                                             |
| 280 ~ 290                               | 77                                             |
| 290 ~ 300                               | 77                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.01 |
| Specific Gravity $d$                                     | 3.43 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.6                                                             | 1.8 | 2.0 | 2.0 | 2.1 | 2.1 | 2.2 | 2.5 | 2.5 | 2.7 | 3.0 | 3.5 |
| -60 ~ -40                                    | 1.6                                                             | 1.7 | 2.0 | 2.0 | 2.0 | 2.1 | 2.2 | 2.4 | 2.4 | 2.6 | 3.0 | 3.4 |
| -40 ~ -20                                    | 1.6                                                             | 1.7 | 2.0 | 2.1 | 2.1 | 2.2 | 2.3 | 2.5 | 2.5 | 2.7 | 3.0 | 3.5 |
| -20 ~ 0                                      | 1.7                                                             | 1.8 | 2.0 | 2.1 | 2.1 | 2.3 | 2.4 | 2.6 | 2.6 | 2.9 | 3.1 | 3.6 |
| 0 ~ 20                                       | 1.9                                                             | 2.0 | 2.2 | 2.3 | 2.3 | 2.4 | 2.5 | 2.7 | 2.7 | 3.0 | 3.4 | 3.9 |
| 20 ~ 40                                      | 2.0                                                             | 2.1 | 2.3 | 2.4 | 2.4 | 2.5 | 2.6 | 2.9 | 2.9 | 3.2 | 3.4 | 4.1 |
| 40 ~ 60                                      | 2.1                                                             | 2.2 | 2.5 | 2.5 | 2.5 | 2.7 | 2.8 | 3.0 | 3.0 | 3.4 | 3.7 | 4.2 |
| 60 ~ 80                                      | 2.3                                                             | 2.4 | 2.6 | 2.7 | 2.7 | 2.8 | 3.0 | 3.2 | 3.2 | 3.5 | 3.8 | 4.4 |
| 80 ~ 100                                     | 2.4                                                             | 2.5 | 2.8 | 2.9 | 2.9 | 3.0 | 3.1 | 3.4 | 3.4 | 3.7 | 4.0 | 4.6 |
| 100 ~ 120                                    | 2.5                                                             | 2.7 | 2.9 | 3.0 | 3.0 | 3.1 | 3.2 | 3.5 | 3.5 | 3.8 | 4.2 | 4.8 |
| 120 ~ 140                                    | 2.6                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.2 | 3.3 | 3.6 | 3.6 | 3.9 | 4.3 | 4.9 |
| 140 ~ 160                                    | 2.6                                                             | 2.8 | 3.0 | 3.1 | 3.1 | 3.3 | 3.4 | 3.7 | 3.7 | 4.0 | 4.4 | 5.1 |
| 160 ~ 180                                    | 2.6                                                             | 2.8 | 3.0 | 3.2 | 3.2 | 3.4 | 3.5 | 3.8 | 3.8 | 4.2 | 4.5 | 5.2 |

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## S-BSM15

Code(d) 623582

Code(e) 626579

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.622 99<br>1.622 992 | Abbe Number $\nu_d$ | 58.16 | Dispersion $n_F - n_C$       | 0.010 711 |
| Refractive Index $n_e$ | 1.625 545             | Abbe Number $\nu_e$ | 57.89 | Dispersion $n_{F'} - n_{C'}$ | 0.010 805 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.592 36 |
| $n_{1970}$         | 1.970 09  | 1.597 97 |
| $n_{1530}$         | 1.529 58  | 1.603 99 |
| $n_{1129}$         | 1.128 64  | 1.609 27 |
| $n_t$              | 1.013 98  | 1.611 00 |
| $n_s$              | 0.852 11  | 1.613 99 |
| $n_{A'}$           | 0.768 19  | 1.616 03 |
| $n_F$              | 0.706 52  | 1.617 89 |
| $n_C$              | 0.656 27  | 1.619 74 |
| $n_{C'}$           | 0.643 85  | 1.620 26 |
| $n_{He-Ne}$        | 0.632 8   | 1.620 74 |
| $n_D$              | 0.589 29  | 1.622 90 |
| $n_d$              | 0.587 56  | 1.622 99 |
| $n_e$              | 0.546 07  | 1.625 55 |
| $n_F$              | 0.486 13  | 1.630 45 |
| $n_{F'}$           | 0.479 99  | 1.631 06 |
| $n_{He-Cd}$        | 0.441 57  | 1.635 52 |
| $n_g$              | 0.435 835 | 1.636 30 |
| $n_h$              | 0.404 656 | 1.641 16 |
| $n_i$              | 0.365 015 | 1.649 48 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.531 283 28E-01 |
| $A_2$                           | 6.376 139 77E-01 |
| $A_3$                           | 1.652 456 47E+00 |
| $B_1$                           | 3.876 389 85E-03 |
| $B_2$                           | 1.850 946 32E-02 |
| $B_3$                           | 1.594 423 67E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 2    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2~3  |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 3.2  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 85.4  |
| Rigidity Modulus G (GPa) | 33.8  |
| Poisson's Ratio $\sigma$ | 0.265 |
| Knoop Hardness Hk[Class] | 560   |
| Abrasion Aa              | 150   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 741 |
| $n_C - n_{A'}$      | 0.003 709 |
| $n_d - n_C$         | 0.003 253 |
| $n_e - n_C$         | 0.005 806 |
| $n_g - n_d$         | 0.013 304 |
| $n_g - n_F$         | 0.005 846 |
| $n_h - n_g$         | 0.004 866 |
| $n_i - n_g$         | 0.013 186 |
| $n_{C'} - n_t$      | 0.009 259 |
| $n_e - n_{C'}$      | 0.005 288 |
| $n_{F'} - n_e$      | 0.005 517 |
| $n_i - n_{F'}$      | 0.018 420 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.816 1 |
| $\theta_{C,A'}$              | 0.346 3 |
| $\theta_{d,C}$               | 0.303 7 |
| $\theta_{e,C}$               | 0.542 1 |
| $\theta_{g,d}$               | 1.242 1 |
| $\theta_{g,F}$               | 0.545 8 |
| $\theta_{h,g}$               | 0.454 3 |
| $\theta_{i,g}$               | 1.231 1 |
| $\theta'_{C,t}$              | 0.856 9 |
| $\theta'_{e,C'}$             | 0.489 4 |
| $\theta'_{F,e}$              | 0.510 6 |
| $\theta'_{i,F'}$             | 1.704 8 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.003 5 |
| $\Delta\theta_{C,A'}$ | -0.000 1 |
| $\Delta\theta_{g,d}$  | -0.001 8 |
| $\Delta\theta_{g,F}$  | -0.001 6 |
| $\Delta\theta_{i,g}$  | -0.006 9 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 360  | $\lambda_5$      | 320 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 357  | $\lambda_{0.05}$ | 327 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.32 | 0.30             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.13             |
| 340                    | 0.44             |
| 350                    | 0.70             |
| 360                    | 0.85             |
| 370                    | 0.926            |
| 380                    | 0.959            |
| 390                    | 0.976            |
| 400                    | 0.985            |
| 420                    | 0.991            |
| 440                    | 0.992            |
| 460                    | 0.994            |
| 480                    | 0.995            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.991            |
| 1 600                  | 0.994            |
| 1 800                  | 0.987            |
| 2 000                  | 0.973            |
| 2 200                  | 0.918            |
| 2 400                  | 0.81             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 615   |
| Annealing Point AP (°C)                                          | 639   |
| Transformation Temperature Tg (°C)                               | 661   |
| Yield Point At (°C)                                              | 704   |
| Softening Point SP (°C)                                          | 746   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 66    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 79    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.845 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 55                                             |
| -90 ~ -80                               | 56                                             |
| -80 ~ -70                               | 57                                             |
| -70 ~ -60                               | 58                                             |
| -60 ~ -50                               | 59                                             |
| -50 ~ -40                               | 60                                             |
| -40 ~ -30                               | 61                                             |
| -30 ~ -20                               | 62                                             |
| -20 ~ -10                               | 63                                             |
| -10 ~ 0                                 | 64                                             |
| 0 ~ 10                                  | 65                                             |
| 10 ~ 20                                 | 66                                             |
| 20 ~ 30                                 | 67                                             |
| 30 ~ 40                                 | 68                                             |
| 40 ~ 50                                 | 69                                             |
| 50 ~ 60                                 | 70                                             |
| 60 ~ 70                                 | 70                                             |
| 70 ~ 80                                 | 71                                             |
| 80 ~ 90                                 | 72                                             |
| 90 ~ 100                                | 73                                             |
| 100 ~ 110                               | 73                                             |
| 110 ~ 120                               | 74                                             |
| 120 ~ 130                               | 75                                             |
| 130 ~ 140                               | 76                                             |
| 140 ~ 150                               | 76                                             |
| 150 ~ 160                               | 77                                             |
| 160 ~ 170                               | 77                                             |
| 170 ~ 180                               | 78                                             |
| 180 ~ 190                               | 79                                             |
| 190 ~ 200                               | 79                                             |
| 200 ~ 210                               | 80                                             |
| 210 ~ 220                               | 80                                             |
| 220 ~ 230                               | 81                                             |
| 230 ~ 240                               | 81                                             |
| 240 ~ 250                               | 82                                             |
| 250 ~ 260                               | 82                                             |
| 260 ~ 270                               | 83                                             |
| 270 ~ 280                               | 83                                             |
| 280 ~ 290                               | 83                                             |
| 290 ~ 300                               | 84                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.80 |
| Specific Gravity $d$                                      | 3.60 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 0.9                                                             | 1.0 | 1.1 | 1.2 | 1.2 | 1.4 | 1.5 | 1.7 | 1.7 | 2.0 | 2.3 | 2.8 |
| -60 ~ -40                                    | 0.8                                                             | 0.9 | 1.1 | 1.1 | 1.2 | 1.3 | 1.4 | 1.7 | 1.7 | 2.0 | 2.2 | 2.8 |
| -40 ~ -20                                    | 0.7                                                             | 0.9 | 1.1 | 1.2 | 1.2 | 1.3 | 1.4 | 1.6 | 1.7 | 2.0 | 2.3 | 2.9 |
| -20 ~ 0                                      | 0.8                                                             | 0.9 | 1.2 | 1.3 | 1.3 | 1.4 | 1.5 | 1.8 | 1.8 | 2.1 | 2.4 | 3.0 |
| 0 ~ 20                                       | 1.0                                                             | 1.1 | 1.3 | 1.3 | 1.4 | 1.5 | 1.6 | 1.9 | 1.9 | 2.3 | 2.6 | 3.2 |
| 20 ~ 40                                      | 1.1                                                             | 1.2 | 1.4 | 1.5 | 1.5 | 1.6 | 1.8 | 2.0 | 2.1 | 2.4 | 2.8 | 3.4 |
| 40 ~ 60                                      | 1.2                                                             | 1.3 | 1.5 | 1.6 | 1.6 | 1.9 | 2.0 | 2.3 | 2.3 | 2.6 | 3.0 | 3.6 |
| 60 ~ 80                                      | 1.3                                                             | 1.5 | 1.7 | 1.8 | 1.8 | 1.9 | 2.1 | 2.4 | 2.4 | 2.7 | 3.1 | 3.9 |
| 80 ~ 100                                     | 1.5                                                             | 1.6 | 1.9 | 1.9 | 2.0 | 2.1 | 2.2 | 2.5 | 2.6 | 2.9 | 3.3 | 4.0 |
| 100 ~ 120                                    | 1.6                                                             | 1.7 | 2.0 | 2.1 | 2.1 | 2.2 | 2.4 | 2.7 | 2.7 | 3.1 | 3.4 | 4.2 |
| 120 ~ 140                                    | 1.7                                                             | 1.8 | 2.1 | 2.2 | 2.2 | 2.3 | 2.5 | 2.8 | 2.8 | 3.2 | 3.6 | 4.3 |
| 140 ~ 160                                    | 1.7                                                             | 1.8 | 2.1 | 2.2 | 2.2 | 2.4 | 2.6 | 2.9 | 2.9 | 3.3 | 3.8 | 4.5 |
| 160 ~ 180                                    | 1.8                                                             | 2.0 | 2.3 | 2.4 | 2.4 | 2.5 | 2.7 | 3.0 | 3.1 | 3.5 | 3.9 | 4.7 |

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## S-BSM16

Code(d) 620603  
Code(e) 623601

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.620 41<br>1.620 411 | Abbe Number $\nu_d$ | 60.29 | Dispersion $n_F - n_C$       | 0.010 290 |
| Refractive Index $n_e$ | 1.622 865             | Abbe Number $\nu_e$ | 60.03 | Dispersion $n_{F'} - n_{C'}$ | 0.010 376 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.589 57 |
| $n_{1970}$         | 1.970 09  | 1.595 45 |
| $n_{1530}$         | 1.529 58  | 1.601 68 |
| $n_{1129}$         | 1.128 64  | 1.607 02 |
| $n_t$              | 1.013 98  | 1.608 74 |
| $n_s$              | 0.852 11  | 1.611 70 |
| $n_{A'}$           | 0.768 19  | 1.613 68 |
| $n_F$              | 0.706 52  | 1.615 49 |
| $n_C$              | 0.656 27  | 1.617 28 |
| $n_{C'}$           | 0.643 85  | 1.617 78 |
| $n_{He-Ne}$        | 0.632 8   | 1.618 24 |
| $n_D$              | 0.589 29  | 1.620 32 |
| $n_d$              | 0.587 56  | 1.620 41 |
| $n_e$              | 0.546 07  | 1.622 87 |
| $n_F$              | 0.486 13  | 1.627 57 |
| $n_{F'}$           | 0.479 99  | 1.628 15 |
| $n_{He-Cd}$        | 0.441 57  | 1.632 41 |
| $n_g$              | 0.435 835 | 1.633 15 |
| $n_h$              | 0.404 656 | 1.637 78 |
| $n_i$              | 0.365 015 | 1.645 67 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 1.144 903 83E+00  |
| $A_2$                           | 4.395 639 11E-01  |
| $A_3$                           | 1.276 880 79E+00  |
| $B_1$                           | 1.370 349 16E-02  |
| $B_2$                           | -1.865 142 05E-03 |
| $B_3$                           | 1.195 355 85E+02  |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 3    |
| Acid Resistance(Powder) Group RA(P)       | 5    |
| Weathering Resistance(Surface) Group W(S) | 2~3  |
| Acid Resistance(Surface) Group SR         | 53.2 |
| Phosphate Resistance PR                   | 4.2  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 87.8  |
| Rigidity Modulus G (GPa) | 34.8  |
| Poisson's Ratio $\sigma$ | 0.262 |
| Knoop Hardness Hk[Class] | 570 6 |
| Abrasion Aa              | 155   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 531 |
| $n_C - n_{A'}$      | 0.003 595 |
| $n_d - n_C$         | 0.003 135 |
| $n_e - n_C$         | 0.005 589 |
| $n_g - n_d$         | 0.012 739 |
| $n_g - n_F$         | 0.005 584 |
| $n_h - n_g$         | 0.004 632 |
| $n_i - n_g$         | 0.012 520 |
| $n_{C'} - n_t$      | 0.009 030 |
| $n_e - n_{C'}$      | 0.005 090 |
| $n_{F'} - n_e$      | 0.005 286 |
| $n_i - n_{F'}$      | 0.017 519 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.829 1 |
| $\theta_{C,A'}$              | 0.349 4 |
| $\theta_{d,C}$               | 0.304 7 |
| $\theta_{e,C}$               | 0.543 1 |
| $\theta_{g,d}$               | 1.238 0 |
| $\theta_{g,F}$               | 0.542 7 |
| $\theta_{h,g}$               | 0.450 1 |
| $\theta_{i,g}$               | 1.216 7 |
| $\theta'_{C,t}$              | 0.870 3 |
| $\theta'_{e,C'}$             | 0.490 6 |
| $\theta'_{F',e}$             | 0.509 4 |
| $\theta'_{i,F'}$             | 1.688 4 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.000 5 |
| $\Delta\theta_{C,A'}$ | 0.000 4  |
| $\Delta\theta_{g,d}$  | -0.001 5 |
| $\Delta\theta_{g,F}$  | -0.001 2 |
| $\Delta\theta_{i,g}$  | -0.003 5 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 350  | $\lambda_5$      | 305 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 346  | $\lambda_{0.05}$ | 312 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.28 | 0.23             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.01             |
| 320                    | 0.18             |
| 330                    | 0.49             |
| 340                    | 0.72             |
| 350                    | 0.85             |
| 360                    | 0.924            |
| 370                    | 0.959            |
| 380                    | 0.976            |
| 390                    | 0.984            |
| 400                    | 0.989            |
| 420                    | 0.992            |
| 440                    | 0.993            |
| 460                    | 0.994            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.992            |
| 1 600                  | 0.995            |
| 1 800                  | 0.987            |
| 2 000                  | 0.972            |
| 2 200                  | 0.911            |
| 2 400                  | 0.79             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 606   |
| Annealing Point AP (°C)                                          | 634   |
| Transformation Temperature Tg (°C)                               | 657   |
| Yield Point At (°C)                                              | 699   |
| Softening Point SP (°C)                                          | 738   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 67    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 80    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.835 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 54                                             |
| -90 ~ -80                               | 56                                             |
| -80 ~ -70                               | 57                                             |
| -70 ~ -60                               | 58                                             |
| -60 ~ -50                               | 59                                             |
| -50 ~ -40                               | 60                                             |
| -40 ~ -30                               | 61                                             |
| -30 ~ -20                               | 62                                             |
| -20 ~ -10                               | 63                                             |
| -10 ~ 0                                 | 64                                             |
| 0 ~ 10                                  | 65                                             |
| 10 ~ 20                                 | 66                                             |
| 20 ~ 30                                 | 67                                             |
| 30 ~ 40                                 | 68                                             |
| 40 ~ 50                                 | 69                                             |
| 50 ~ 60                                 | 70                                             |
| 60 ~ 70                                 | 71                                             |
| 70 ~ 80                                 | 71                                             |
| 80 ~ 90                                 | 72                                             |
| 90 ~ 100                                | 73                                             |
| 100 ~ 110                               | 74                                             |
| 110 ~ 120                               | 75                                             |
| 120 ~ 130                               | 75                                             |
| 130 ~ 140                               | 76                                             |
| 140 ~ 150                               | 77                                             |
| 150 ~ 160                               | 78                                             |
| 160 ~ 170                               | 78                                             |
| 170 ~ 180                               | 79                                             |
| 180 ~ 190                               | 79                                             |
| 190 ~ 200                               | 80                                             |
| 200 ~ 210                               | 81                                             |
| 210 ~ 220                               | 81                                             |
| 220 ~ 230                               | 82                                             |
| 230 ~ 240                               | 82                                             |
| 240 ~ 250                               | 83                                             |
| 250 ~ 260                               | 83                                             |
| 260 ~ 270                               | 84                                             |
| 270 ~ 280                               | 84                                             |
| 280 ~ 290                               | 85                                             |
| 290 ~ 300                               | 85                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.81 |
| Specific Gravity $d$                                     | 3.59 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 0.5                                                             | 0.6 | 0.8 | 0.8 | 0.9 | 1.0 | 1.2 | 1.4 | 1.4 | 1.6 | 2.0 | 2.4 |
| -60 ~ -40                                    | 0.4                                                             | 0.6 | 0.8 | 0.8 | 0.8 | 0.9 | 1.0 | 1.2 | 1.3 | 1.6 | 1.9 | 2.3 |
| -40 ~ -20                                    | 0.4                                                             | 0.6 | 0.8 | 0.9 | 0.9 | 1.0 | 1.1 | 1.3 | 1.3 | 1.6 | 1.9 | 2.4 |
| -20 ~ 0                                      | 0.5                                                             | 0.6 | 0.9 | 1.0 | 1.0 | 1.1 | 1.2 | 1.4 | 1.5 | 1.7 | 2.0 | 2.6 |
| 0 ~ 20                                       | 0.7                                                             | 0.8 | 1.0 | 1.0 | 1.1 | 1.2 | 1.3 | 1.5 | 1.5 | 1.9 | 2.2 | 2.7 |
| 20 ~ 40                                      | 0.8                                                             | 0.9 | 1.1 | 1.2 | 1.2 | 1.3 | 1.4 | 1.7 | 1.7 | 2.0 | 2.4 | 2.9 |
| 40 ~ 60                                      | 0.9                                                             | 1.0 | 1.2 | 1.3 | 1.3 | 1.5 | 1.7 | 1.9 | 2.0 | 2.2 | 2.5 | 3.1 |
| 60 ~ 80                                      | 1.1                                                             | 1.2 | 1.4 | 1.5 | 1.5 | 1.6 | 1.8 | 2.0 | 2.1 | 2.4 | 2.6 | 3.3 |
| 80 ~ 100                                     | 1.2                                                             | 1.3 | 1.6 | 1.7 | 1.7 | 1.8 | 1.9 | 2.2 | 2.2 | 2.5 | 2.8 | 3.4 |
| 100 ~ 120                                    | 1.3                                                             | 1.5 | 1.7 | 1.8 | 1.8 | 1.9 | 2.1 | 2.3 | 2.4 | 2.7 | 3.0 | 3.6 |
| 120 ~ 140                                    | 1.4                                                             | 1.5 | 1.8 | 1.9 | 1.9 | 2.0 | 2.2 | 2.5 | 2.5 | 2.8 | 3.1 | 3.7 |
| 140 ~ 160                                    | 1.5                                                             | 1.6 | 1.9 | 2.0 | 2.0 | 2.1 | 2.3 | 2.5 | 2.6 | 2.9 | 3.3 | 3.9 |
| 160 ~ 180                                    | 1.5                                                             | 1.7 | 2.0 | 2.1 | 2.1 | 2.3 | 2.4 | 2.7 | 2.7 | 3.0 | 3.4 | 4.0 |

OHARA 25-04

## S-BSM18

Code(d) 639554

Code(e) 641551

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.638 54<br>1.638 539 | Abbe Number $\nu_d$ | 55.38 | Dispersion $n_F - n_C$       | 0.011 531 |
| Refractive Index $n_e$ | 1.641 287             | Abbe Number $\nu_e$ | 55.10 | Dispersion $n_{F'} - n_{C'}$ | 0.011 638 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.607 79 |
| $n_{1970}$         | 1.970 09  | 1.613 14 |
| $n_{1530}$         | 1.529 58  | 1.618 92 |
| $n_{1129}$         | 1.128 64  | 1.624 11 |
| $n_t$              | 1.013 98  | 1.625 86 |
| $n_s$              | 0.852 11  | 1.628 96 |
| $n_{A'}$           | 0.768 19  | 1.631 11 |
| $n_F$              | 0.706 52  | 1.633 08 |
| $n_C$              | 0.656 27  | 1.635 05 |
| $n_{C'}$           | 0.643 85  | 1.635 60 |
| $n_{He-Ne}$        | 0.632 8   | 1.636 12 |
| $n_D$              | 0.589 29  | 1.638 44 |
| $n_d$              | 0.587 56  | 1.638 54 |
| $n_e$              | 0.546 07  | 1.641 29 |
| $n_F$              | 0.486 13  | 1.646 58 |
| $n_{F'}$           | 0.479 99  | 1.647 24 |
| $n_{He-Cd}$        | 0.441 57  | 1.652 07 |
| $n_g$              | 0.435 835 | 1.652 91 |
| $n_h$              | 0.404 656 | 1.658 18 |
| $n_i$              | 0.365 015 | 1.667 20 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.278 860 25E-01 |
| $A_2$                           | 7.088 585 26E-01 |
| $A_3$                           | 1.186 108 97E+00 |
| $B_1$                           | 4.175 491 99E-03 |
| $B_2$                           | 1.846 918 38E-02 |
| $B_3$                           | 1.222 104 16E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 88.5    |
| Rigidity Modulus G (GPa) | 34.9    |
| Poisson's Ratio $\sigma$ | 0.268   |
| Knoop Hardness Hk[Class] | 570   6 |
| Abrasion Aa              | 155     |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.009 188 |
| $n_C - n_{A'}$      | 0.003 946 |
| $n_d - n_C$         | 0.003 488 |
| $n_e - n_C$         | 0.006 236 |
| $n_g - n_d$         | 0.014 367 |
| $n_g - n_F$         | 0.006 324 |
| $n_h - n_g$         | 0.005 271 |
| $n_i - n_g$         | 0.014 291 |
| $n_{C'} - n_t$      | 0.009 742 |
| $n_e - n_{C'}$      | 0.005 682 |
| $n_{F'} - n_e$      | 0.005 956 |
| $n_i - n_{F'}$      | 0.019 954 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.796 8 |
| $\theta_{C,A'}$              | 0.342 2 |
| $\theta_{d,C}$               | 0.302 5 |
| $\theta_{e,C}$               | 0.540 8 |
| $\theta_{g,d}$               | 1.245 9 |
| $\theta_{g,F}$               | 0.548 4 |
| $\theta_{h,g}$               | 0.457 1 |
| $\theta_{i,g}$               | 1.239 4 |
| $\theta'_{C,t}$              | 0.837 1 |
| $\theta'_{e,C'}$             | 0.488 2 |
| $\theta'_{F,e}$              | 0.511 8 |
| $\theta'_{i,F'}$             | 1.714 6 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.009 7 |
| $\Delta\theta_{C,A'}$ | -0.000 8 |
| $\Delta\theta_{g,d}$  | -0.003 8 |
| $\Delta\theta_{g,F}$  | -0.003 5 |
| $\Delta\theta_{i,g}$  | -0.021 9 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 350  | $\lambda_5$      | 305 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 345  | $\lambda_{0.05}$ | 309 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.21 | 0.22             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.08             |
| 320                    | 0.31             |
| 330                    | 0.57             |
| 340                    | 0.75             |
| 350                    | 0.86             |
| 360                    | 0.929            |
| 370                    | 0.961            |
| 380                    | 0.977            |
| 390                    | 0.985            |
| 400                    | 0.990            |
| 420                    | 0.993            |
| 440                    | 0.994            |
| 460                    | 0.995            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.993            |
| 1 600                  | 0.994            |
| 1 800                  | 0.986            |
| 2 000                  | 0.973            |
| 2 200                  | 0.924            |
| 2 400                  | 0.84             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 567   |
| Annealing Point AP (°C)                                          | 600   |
| Transformation Temperature Tg (°C)                               | 617   |
| Yield Point At (°C)                                              | 661   |
| Softening Point SP (°C)                                          | 717   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 70    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 82    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.815 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 57                                             |
| -90 ~ -80                               | 59                                             |
| -80 ~ -70                               | 60                                             |
| -70 ~ -60                               | 61                                             |
| -60 ~ -50                               | 62                                             |
| -50 ~ -40                               | 63                                             |
| -40 ~ -30                               | 64                                             |
| -30 ~ -20                               | 65                                             |
| -20 ~ -10                               | 66                                             |
| -10 ~ 0                                 | 67                                             |
| 0 ~ 10                                  | 68                                             |
| 10 ~ 20                                 | 69                                             |
| 20 ~ 30                                 | 70                                             |
| 30 ~ 40                                 | 71                                             |
| 40 ~ 50                                 | 71                                             |
| 50 ~ 60                                 | 72                                             |
| 60 ~ 70                                 | 73                                             |
| 70 ~ 80                                 | 74                                             |
| 80 ~ 90                                 | 75                                             |
| 90 ~ 100                                | 76                                             |
| 100 ~ 110                               | 76                                             |
| 110 ~ 120                               | 77                                             |
| 120 ~ 130                               | 78                                             |
| 130 ~ 140                               | 78                                             |
| 140 ~ 150                               | 79                                             |
| 150 ~ 160                               | 80                                             |
| 160 ~ 170                               | 80                                             |
| 170 ~ 180                               | 81                                             |
| 180 ~ 190                               | 82                                             |
| 190 ~ 200                               | 82                                             |
| 200 ~ 210                               | 83                                             |
| 210 ~ 220                               | 83                                             |
| 220 ~ 230                               | 84                                             |
| 230 ~ 240                               | 84                                             |
| 240 ~ 250                               | 85                                             |
| 250 ~ 260                               | 85                                             |
| 260 ~ 270                               | 85                                             |
| 270 ~ 280                               | 86                                             |
| 280 ~ 290                               | 86                                             |
| 290 ~ 300                               | 87                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.79 |
| Specific Gravity $d$                                      | 3.69 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.4                                                             | 1.5 | 1.8 | 1.8 | 1.9 | 2.0 | 2.1 | 2.3 | 2.3 | 2.6 | 3.0 | 3.5 |
| -60 ~ -40                                    | 1.3                                                             | 1.4 | 1.6 | 1.7 | 1.7 | 1.8 | 2.0 | 2.3 | 2.3 | 2.6 | 2.9 | 3.6 |
| -40 ~ -20                                    | 1.3                                                             | 1.4 | 1.6 | 1.7 | 1.7 | 1.8 | 2.0 | 2.3 | 2.3 | 2.7 | 3.0 | 3.6 |
| -20 ~ 0                                      | 1.3                                                             | 1.5 | 1.7 | 1.8 | 1.8 | 1.9 | 2.1 | 2.3 | 2.4 | 2.7 | 3.1 | 3.7 |
| 0 ~ 20                                       | 1.4                                                             | 1.5 | 1.7 | 1.8 | 1.9 | 2.0 | 2.1 | 2.5 | 2.6 | 2.9 | 3.2 | 3.9 |
| 20 ~ 40                                      | 1.4                                                             | 1.6 | 1.9 | 1.9 | 2.0 | 2.1 | 2.3 | 2.6 | 2.6 | 3.1 | 3.4 | 4.1 |
| 40 ~ 60                                      | 1.5                                                             | 1.7 | 2.0 | 2.1 | 2.2 | 2.3 | 2.5 | 2.8 | 2.8 | 3.2 | 3.6 | 4.3 |
| 60 ~ 80                                      | 1.7                                                             | 1.8 | 2.1 | 2.2 | 2.2 | 2.4 | 2.5 | 2.9 | 2.9 | 3.3 | 3.8 | 4.5 |
| 80 ~ 100                                     | 1.8                                                             | 1.9 | 2.2 | 2.3 | 2.4 | 2.5 | 2.7 | 3.0 | 3.1 | 3.5 | 3.9 | 4.6 |
| 100 ~ 120                                    | 1.8                                                             | 2.0 | 2.3 | 2.4 | 2.5 | 2.6 | 2.8 | 3.1 | 3.2 | 3.6 | 4.0 | 4.8 |
| 120 ~ 140                                    | 1.9                                                             | 2.0 | 2.4 | 2.5 | 2.5 | 2.7 | 2.9 | 3.2 | 3.3 | 3.7 | 4.1 | 5.0 |
| 140 ~ 160                                    | 1.9                                                             | 2.1 | 2.4 | 2.5 | 2.5 | 2.7 | 2.9 | 3.3 | 3.3 | 3.9 | 4.3 | 5.2 |
| 160 ~ 180                                    | 2.0                                                             | 2.1 | 2.5 | 2.6 | 2.7 | 2.8 | 3.0 | 3.4 | 3.4 | 3.9 | 4.4 | 5.2 |

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## S-BSM25

Code(d) 658509

Code(e) 662506

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.658 44<br>1.658 441 | Abbe Number $\nu_d$ | 50.88 | Dispersion $n_F - n_C$       | 0.012 942 |
| Refractive Index $n_e$ | 1.661 522             | Abbe Number $\nu_e$ | 50.59 | Dispersion $n_{F'} - n_{C'}$ | 0.013 076 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.626 13 |
| $n_{1970}$         | 1.970 09  | 1.631 45 |
| $n_{1530}$         | 1.529 58  | 1.637 27 |
| $n_{1129}$         | 1.128 64  | 1.642 64 |
| $n_t$              | 1.013 98  | 1.644 50 |
| $n_s$              | 0.852 11  | 1.647 85 |
| $n_{A'}$           | 0.768 19  | 1.650 19 |
| $n_F$              | 0.706 52  | 1.652 37 |
| $n_C$              | 0.656 27  | 1.654 55 |
| $n_{C'}$           | 0.643 85  | 1.655 17 |
| $n_{He-Ne}$        | 0.632 8   | 1.655 74 |
| $n_D$              | 0.589 29  | 1.658 33 |
| $n_d$              | 0.587 56  | 1.658 44 |
| $n_e$              | 0.546 07  | 1.661 52 |
| $n_F$              | 0.486 13  | 1.667 49 |
| $n_{F'}$           | 0.479 99  | 1.668 24 |
| $n_{He-Cd}$        | 0.441 57  | 1.673 73 |
| $n_g$              | 0.435 835 | 1.674 69 |
| $n_h$              | 0.404 656 | 1.680 74 |
| $n_i$              | 0.365 015 | 1.691 21 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.348 142 57E+00 |
| $A_2$                           | 3.475 303 19E-01 |
| $A_3$                           | 1.387 983 68E+00 |
| $B_1$                           | 6.953 643 66E-03 |
| $B_2$                           | 2.778 634 78E-02 |
| $B_3$                           | 1.421 381 22E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 2   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 5,2 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 95.1  |
| Rigidity Modulus G (GPa) | 37.4  |
| Poisson's Ratio $\sigma$ | 0.272 |
| Knoop Hardness Hk[Class] | 620 6 |
| Abrasion Aa              | 136   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 049 |
| $n_C - n_{A'}$      | 0.004 361 |
| $n_d - n_C$         | 0.003 888 |
| $n_e - n_C$         | 0.006 969 |
| $n_g - n_d$         | 0.016 250 |
| $n_g - n_F$         | 0.007 196 |
| $n_h - n_g$         | 0.006 049 |
| $n_i - n_g$         | 0.016 516 |
| $n_{C'} - n_t$      | 0.010 664 |
| $n_e - n_{C'}$      | 0.006 354 |
| $n_{F'} - n_e$      | 0.006 722 |
| $n_i - n_{F'}$      | 0.022 963 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.776 5 |
| $\theta_{C,A'}$              | 0.337 0 |
| $\theta_{d,C}$               | 0.300 4 |
| $\theta_{e,C}$               | 0.538 5 |
| $\theta_{g,d}$               | 1.255 6 |
| $\theta_{g,F}$               | 0.556 0 |
| $\theta_{h,g}$               | 0.467 4 |
| $\theta_{i,g}$               | 1.276 2 |
| $\theta'_{C,t}$              | 0.815 5 |
| $\theta'_{e,C'}$             | 0.485 9 |
| $\theta'_{F,e}$              | 0.514 1 |
| $\theta'_{i,F'}$             | 1.756 1 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.008 9 |
| $\Delta\theta_{C,A'}$ | -0.000 5 |
| $\Delta\theta_{g,d}$  | -0.003 4 |
| $\Delta\theta_{g,F}$  | -0.003 1 |
| $\Delta\theta_{i,g}$  | -0.022 8 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 375  | $\lambda_5$      | 330 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 367  | $\lambda_{0.05}$ | 331 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.71 | 0.70             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.03             |
| 340                    | 0.19             |
| 350                    | 0.48             |
| 360                    | 0.71             |
| 370                    | 0.84             |
| 380                    | 0.910            |
| 390                    | 0.945            |
| 400                    | 0.964            |
| 420                    | 0.980            |
| 440                    | 0.984            |
| 460                    | 0.988            |
| 480                    | 0.991            |
| 500                    | 0.994            |
| 550                    | 0.996            |
| 600                    | 0.995            |
| 650                    | 0.995            |
| 700                    | 0.996            |
| 800                    | 0.997            |
| 900                    | 0.997            |
| 1 000                  | 0.996            |
| 1 200                  | 0.997            |
| 1 400                  | 0.995            |
| 1 600                  | 0.995            |
| 1 800                  | 0.989            |
| 2 000                  | 0.980            |
| 2 200                  | 0.947            |
| 2 400                  | 0.87             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 605   |
| Annealing Point AP (°C)                                          | 630   |
| Transformation Temperature Tg (°C)                               | 637   |
| Yield Point At (°C)                                              | 697   |
| Softening Point SP (°C)                                          | 760   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 68    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 82    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.891 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 54                                             |
| -90 ~ -80                               | 56                                             |
| -80 ~ -70                               | 57                                             |
| -70 ~ -60                               | 58                                             |
| -60 ~ -50                               | 59                                             |
| -50 ~ -40                               | 61                                             |
| -40 ~ -30                               | 62                                             |
| -30 ~ -20                               | 63                                             |
| -20 ~ -10                               | 64                                             |
| -10 ~ 0                                 | 65                                             |
| 0 ~ 10                                  | 66                                             |
| 10 ~ 20                                 | 67                                             |
| 20 ~ 30                                 | 68                                             |
| 30 ~ 40                                 | 69                                             |
| 40 ~ 50                                 | 70                                             |
| 50 ~ 60                                 | 71                                             |
| 60 ~ 70                                 | 72                                             |
| 70 ~ 80                                 | 73                                             |
| 80 ~ 90                                 | 74                                             |
| 90 ~ 100                                | 75                                             |
| 100 ~ 110                               | 76                                             |
| 110 ~ 120                               | 76                                             |
| 120 ~ 130                               | 77                                             |
| 130 ~ 140                               | 78                                             |
| 140 ~ 150                               | 79                                             |
| 150 ~ 160                               | 79                                             |
| 160 ~ 170                               | 80                                             |
| 170 ~ 180                               | 81                                             |
| 180 ~ 190                               | 81                                             |
| 190 ~ 200                               | 82                                             |
| 200 ~ 210                               | 83                                             |
| 210 ~ 220                               | 83                                             |
| 220 ~ 230                               | 84                                             |
| 230 ~ 240                               | 84                                             |
| 240 ~ 250                               | 85                                             |
| 250 ~ 260                               | 85                                             |
| 260 ~ 270                               | 86                                             |
| 270 ~ 280                               | 86                                             |
| 280 ~ 290                               | 87                                             |
| 290 ~ 300                               | 87                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.08 |
| Specific Gravity $d$                                     | 3.50 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.8                                                             | 3.0 | 3.3 | 3.4 | 3.4 | 3.6 | 3.7 | 4.2 | 4.2 | 4.6 | 5.0 | 5.9 |
| -60 ~ -40                                    | 2.7                                                             | 2.9 | 3.3 | 3.4 | 3.4 | 3.6 | 3.7 | 4.1 | 4.1 | 4.5 | 5.0 | 5.8 |
| -40 ~ -20                                    | 2.7                                                             | 2.9 | 3.2 | 3.3 | 3.3 | 3.6 | 3.8 | 4.1 | 4.2 | 4.6 | 5.0 | 5.9 |
| -20 ~ 0                                      | 2.7                                                             | 2.9 | 3.3 | 3.4 | 3.4 | 3.6 | 3.7 | 4.1 | 4.2 | 4.7 | 5.1 | 6.0 |
| 0 ~ 20                                       | 2.8                                                             | 3.0 | 3.3 | 3.5 | 3.6 | 3.7 | 3.9 | 4.3 | 4.4 | 4.8 | 5.3 | 6.2 |
| 20 ~ 40                                      | 2.9                                                             | 3.1 | 3.4 | 3.5 | 3.6 | 3.8 | 4.1 | 4.5 | 4.5 | 5.0 | 5.5 | 6.4 |
| 40 ~ 60                                      | 2.9                                                             | 3.2 | 3.6 | 3.7 | 3.8 | 4.0 | 4.2 | 4.6 | 4.6 | 5.1 | 5.6 | 6.6 |
| 60 ~ 80                                      | 3.1                                                             | 3.3 | 3.7 | 3.8 | 3.8 | 4.1 | 4.3 | 4.7 | 4.8 | 5.3 | 5.9 | 6.9 |
| 80 ~ 100                                     | 3.2                                                             | 3.4 | 3.8 | 3.9 | 4.0 | 4.2 | 4.4 | 4.8 | 4.9 | 5.4 | 6.0 | 7.1 |
| 100 ~ 120                                    | 3.3                                                             | 3.5 | 3.9 | 4.0 | 4.1 | 4.3 | 4.5 | 5.0 | 5.0 | 5.6 | 6.1 | 7.2 |
| 120 ~ 140                                    | 3.3                                                             | 3.6 | 4.0 | 4.1 | 4.2 | 4.4 | 4.6 | 5.1 | 5.1 | 5.7 | 6.3 | 7.5 |
| 140 ~ 160                                    | 3.3                                                             | 3.6 | 4.0 | 4.2 | 4.2 | 4.4 | 4.7 | 5.3 | 5.3 | 5.9 | 6.5 | 7.6 |
| 160 ~ 180                                    | 3.4                                                             | 3.7 | 4.1 | 4.3 | 4.3 | 4.6 | 4.8 | 5.3 | 5.4 | 5.9 | 6.5 | 7.7 |

## S-BSM28

Code(d) 618498

Code(e) 621495

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.617 72<br>1.617 722 | Abbe Number $\nu_d$ | 49.81 | Dispersion $n_F - n_C$       | 0.012 401 |
| Refractive Index $n_e$ | 1.620 671             | Abbe Number $\nu_e$ | 49.52 | Dispersion $n_{F'} - n_{C'}$ | 0.012 534 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.586 52 |
| $n_{1970}$         | 1.970 09  | 1.591 73 |
| $n_{1530}$         | 1.529 58  | 1.597 40 |
| $n_{1129}$         | 1.128 64  | 1.602 60 |
| $n_t$              | 1.013 98  | 1.604 39 |
| $n_s$              | 0.852 11  | 1.607 60 |
| $n_{A'}$           | 0.768 19  | 1.609 84 |
| $n_F$              | 0.706 52  | 1.611 92 |
| $n_C$              | 0.656 27  | 1.614 01 |
| $n_{C'}$           | 0.643 85  | 1.614 59 |
| $n_{He-Ne}$        | 0.632 8   | 1.615 14 |
| $n_D$              | 0.589 29  | 1.617 61 |
| $n_d$              | 0.587 56  | 1.617 72 |
| $n_e$              | 0.546 07  | 1.620 67 |
| $n_F$              | 0.486 13  | 1.626 41 |
| $n_{F'}$           | 0.479 99  | 1.627 13 |
| $n_{He-Cd}$        | 0.441 57  | 1.632 42 |
| $n_g$              | 0.435 835 | 1.633 35 |
| $n_h$              | 0.404 656 | 1.639 24 |
| $n_i$              | 0.365 015 | 1.649 53 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.438 228 41E+00 |
| $A_2$                           | 1.281 000 17E-01 |
| $A_3$                           | 1.343 555 30E+00 |
| $B_1$                           | 8.597 797 50E-03 |
| $B_2$                           | 4.086 178 54E-02 |
| $B_3$                           | 1.437 098 90E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 2    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 3.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 85.3  |
| Rigidity Modulus G (GPa) | 33.9  |
| Poisson's Ratio $\sigma$ | 0.258 |
| Knoop Hardness Hk[Class] | 560 6 |
| Abrasion Aa              | 176   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.009 612 |
| $n_C - n_{A'}$      | 0.004 166 |
| $n_d - n_C$         | 0.003 717 |
| $n_e - n_C$         | 0.006 666 |
| $n_g - n_d$         | 0.015 632 |
| $n_g - n_F$         | 0.006 948 |
| $n_h - n_g$         | 0.005 882 |
| $n_i - n_g$         | 0.016 179 |
| $n_{C'} - n_t$      | 0.010 200 |
| $n_e - n_{C'}$      | 0.006 078 |
| $n_{F'} - n_e$      | 0.006 456 |
| $n_i - n_{F'}$      | 0.022 406 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.775 1 |
| $\theta_{C,A'}$              | 0.335 9 |
| $\theta_{d,C}$               | 0.299 7 |
| $\theta_{e,C}$               | 0.537 5 |
| $\theta_{g,d}$               | 1.260 5 |
| $\theta_{g,F}$               | 0.560 3 |
| $\theta_{h,g}$               | 0.474 3 |
| $\theta_{i,g}$               | 1.304 7 |
| $\theta'_{C,t}$              | 0.813 8 |
| $\theta'_{e,C'}$             | 0.484 9 |
| $\theta'_{F',e}$             | 0.515 1 |
| $\theta'_{i,F'}$             | 1.787 6 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.005 3 |
| $\Delta\theta_{C,A'}$ | -0.000 3 |
| $\Delta\theta_{g,d}$  | -0.000 8 |
| $\Delta\theta_{g,F}$  | -0.000 6 |
| $\Delta\theta_{i,g}$  | -0.003 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 385  | $\lambda_5$      | 340 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 375  | $\lambda_{0.05}$ | 341 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.01 | 1.02             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.02             |
| 350                    | 0.24             |
| 360                    | 0.54             |
| 370                    | 0.74             |
| 380                    | 0.85             |
| 390                    | 0.918            |
| 400                    | 0.950            |
| 420                    | 0.975            |
| 440                    | 0.982            |
| 460                    | 0.987            |
| 480                    | 0.990            |
| 500                    | 0.993            |
| 550                    | 0.997            |
| 600                    | 0.996            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.997            |
| 900                    | 0.997            |
| 1 000                  | 0.996            |
| 1 200                  | 0.996            |
| 1 400                  | 0.994            |
| 1 600                  | 0.995            |
| 1 800                  | 0.988            |
| 2 000                  | 0.978            |
| 2 200                  | 0.944            |
| 2 400                  | 0.88             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 530   |
| Annealing Point AP (°C)                                          | 559   |
| Transformation Temperature Tg (°C)                               | 579   |
| Yield Point At (°C)                                              | 620   |
| Softening Point SP (°C)                                          | 680   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 84    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 100   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.878 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 70                                             |
| -90 ~ -80                               | 71                                             |
| -80 ~ -70                               | 73                                             |
| -70 ~ -60                               | 74                                             |
| -60 ~ -50                               | 75                                             |
| -50 ~ -40                               | 76                                             |
| -40 ~ -30                               | 78                                             |
| -30 ~ -20                               | 79                                             |
| -20 ~ -10                               | 80                                             |
| -10 ~ 0                                 | 81                                             |
| 0 ~ 10                                  | 82                                             |
| 10 ~ 20                                 | 83                                             |
| 20 ~ 30                                 | 84                                             |
| 30 ~ 40                                 | 86                                             |
| 40 ~ 50                                 | 87                                             |
| 50 ~ 60                                 | 88                                             |
| 60 ~ 70                                 | 89                                             |
| 70 ~ 80                                 | 90                                             |
| 80 ~ 90                                 | 91                                             |
| 90 ~ 100                                | 91                                             |
| 100 ~ 110                               | 92                                             |
| 110 ~ 120                               | 93                                             |
| 120 ~ 130                               | 94                                             |
| 130 ~ 140                               | 95                                             |
| 140 ~ 150                               | 96                                             |
| 150 ~ 160                               | 97                                             |
| 160 ~ 170                               | 98                                             |
| 170 ~ 180                               | 98                                             |
| 180 ~ 190                               | 99                                             |
| 190 ~ 200                               | 100                                            |
| 200 ~ 210                               | 101                                            |
| 210 ~ 220                               | 101                                            |
| 220 ~ 230                               | 102                                            |
| 230 ~ 240                               | 103                                            |
| 240 ~ 250                               | 103                                            |
| 250 ~ 260                               | 104                                            |
| 260 ~ 270                               | 105                                            |
| 270 ~ 280                               | 105                                            |
| 280 ~ 290                               | 106                                            |
| 290 ~ 300                               | 106                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.05 |
| Specific Gravity $d$                                     | 3.23 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 0.1                                                             | 0.2 | 0.4 | 0.5 | 0.5 | 0.7 | 0.9 | 1.2 | 1.3 | 1.6 | 2.1 | 2.9 |
| -60 ~ -40                                    | -0.1                                                            | 0.1 | 0.4 | 0.5 | 0.5 | 0.6 | 0.8 | 1.1 | 1.2 | 1.7 | 2.1 | 2.9 |
| -40 ~ -20                                    | -0.1                                                            | 0.1 | 0.4 | 0.5 | 0.5 | 0.7 | 0.8 | 1.2 | 1.2 | 1.6 | 2.1 | 3.0 |
| -20 ~ 0                                      | -0.1                                                            | 0.1 | 0.5 | 0.6 | 0.6 | 0.8 | 0.9 | 1.3 | 1.3 | 1.8 | 2.2 | 3.2 |
| 0 ~ 20                                       | 0.1                                                             | 0.2 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | 1.4 | 1.4 | 2.0 | 2.4 | 3.4 |
| 20 ~ 40                                      | 0.2                                                             | 0.3 | 0.6 | 0.8 | 0.8 | 1.0 | 1.1 | 1.5 | 1.6 | 2.0 | 2.6 | 3.6 |
| 40 ~ 60                                      | 0.2                                                             | 0.4 | 0.7 | 0.9 | 0.9 | 1.1 | 1.3 | 1.8 | 1.8 | 2.3 | 2.8 | 3.8 |
| 60 ~ 80                                      | 0.4                                                             | 0.6 | 0.9 | 1.0 | 1.1 | 1.3 | 1.4 | 1.9 | 1.9 | 2.4 | 2.9 | 4.1 |
| 80 ~ 100                                     | 0.5                                                             | 0.7 | 1.0 | 1.2 | 1.2 | 1.4 | 1.6 | 2.0 | 2.1 | 2.6 | 3.1 | 4.2 |
| 100 ~ 120                                    | 0.6                                                             | 0.8 | 1.1 | 1.3 | 1.3 | 1.5 | 1.7 | 2.2 | 2.2 | 2.8 | 3.3 | 4.4 |
| 120 ~ 140                                    | 0.6                                                             | 0.8 | 1.2 | 1.3 | 1.4 | 1.6 | 1.8 | 2.3 | 2.3 | 2.9 | 3.4 | 4.6 |
| 140 ~ 160                                    | 0.7                                                             | 0.9 | 1.3 | 1.4 | 1.4 | 1.7 | 1.9 | 2.3 | 2.4 | 3.0 | 3.6 | 4.8 |
| 160 ~ 180                                    | 0.7                                                             | 0.9 | 1.4 | 1.5 | 1.6 | 1.8 | 2.0 | 2.5 | 2.5 | 3.1 | 3.7 | 4.9 |

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## S-BSM71

Code(d) 649530

Code(e) 651527

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.648 50<br>1.648 498 | Abbe Number $\nu_d$ | 53.02 | Dispersion $n_F - n_C$       | 0.012 231 |
| Refractive Index $n_e$ | 1.651 410             | Abbe Number $\nu_e$ | 52.73 | Dispersion $n_{F'} - n_{C'}$ | 0.012 353 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.616 57 |
| $n_{1970}$         | 1.970 09  | 1.622 05 |
| $n_{1530}$         | 1.529 58  | 1.627 99 |
| $n_{1129}$         | 1.128 64  | 1.633 36 |
| $n_t$              | 1.013 98  | 1.635 18 |
| $n_s$              | 0.852 11  | 1.638 42 |
| $n_{A'}$           | 0.768 19  | 1.640 67 |
| $n_F$              | 0.706 52  | 1.642 74 |
| $n_C$              | 0.656 27  | 1.644 82 |
| $n_{C'}$           | 0.643 85  | 1.645 40 |
| $n_{He-Ne}$        | 0.632 8   | 1.645 95 |
| $n_D$              | 0.589 29  | 1.648 39 |
| $n_d$              | 0.587 56  | 1.648 50 |
| $n_e$              | 0.546 07  | 1.651 41 |
| $n_F$              | 0.486 13  | 1.657 05 |
| $n_{F'}$           | 0.479 99  | 1.657 75 |
| $n_{He-Cd}$        | 0.441 57  | 1.662 93 |
| $n_g$              | 0.435 835 | 1.663 83 |
| $n_h$              | 0.404 656 | 1.669 54 |
| $n_i$              | 0.365 015 | 1.679 43 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.508 478 85E+00 |
| $A_2$                           | 1.580 998 26E-01 |
| $A_3$                           | 1.368 153 68E+00 |
| $B_1$                           | 8.127 690 76E-03 |
| $B_2$                           | 3.542 008 98E-02 |
| $B_3$                           | 1.361 100 38E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2~3  |
| Acid Resistance(Surface) Group SR         | 53.2 |
| Phosphate Resistance PR                   | 4.0  |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 86.2    |
| Rigidity Modulus G (GPa) | 33.9    |
| Poisson's Ratio $\sigma$ | 0.273   |
| Knoop Hardness Hk[Class] | 570   6 |
| Abrasion Aa              | 170     |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.009 631 |
| $n_C - n_{A'}$      | 0.004 150 |
| $n_d - n_C$         | 0.003 683 |
| $n_e - n_C$         | 0.006 595 |
| $n_g - n_d$         | 0.015 333 |
| $n_g - n_F$         | 0.006 785 |
| $n_h - n_g$         | 0.005 706 |
| $n_i - n_g$         | 0.015 599 |
| $n_{C'} - n_t$      | 0.010 215 |
| $n_e - n_{C'}$      | 0.006 011 |
| $n_{F'} - n_e$      | 0.006 342 |
| $n_i - n_{F'}$      | 0.021 678 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.787 4 |
| $\theta_{C,A'}$              | 0.339 3 |
| $\theta_{d,C}$               | 0.301 1 |
| $\theta_{e,C}$               | 0.539 2 |
| $\theta_{g,d}$               | 1.253 6 |
| $\theta_{g,F}$               | 0.554 7 |
| $\theta_{h,g}$               | 0.466 5 |
| $\theta_{i,g}$               | 1.275 4 |
| $\theta'_{C,t}$              | 0.826 9 |
| $\theta'_{e,C'}$             | 0.486 6 |
| $\theta'_{F',e}$             | 0.513 4 |
| $\theta'_{i,F'}$             | 1.754 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.008 0 |
| $\Delta\theta_{C,A'}$ | -0.000 8 |
| $\Delta\theta_{g,d}$  | -0.001 0 |
| $\Delta\theta_{g,F}$  | -0.001 0 |
| $\Delta\theta_{i,g}$  | -0.005 7 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 375  | $\lambda_5$      | 335 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 366  | $\lambda_{0.05}$ | 337 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.59 | 0.55             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.15             |
| 350                    | 0.47             |
| 360                    | 0.72             |
| 370                    | 0.86             |
| 380                    | 0.926            |
| 390                    | 0.958            |
| 400                    | 0.973            |
| 420                    | 0.985            |
| 440                    | 0.988            |
| 460                    | 0.990            |
| 480                    | 0.993            |
| 500                    | 0.995            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.993            |
| 1 600                  | 0.993            |
| 1 800                  | 0.985            |
| 2 000                  | 0.972            |
| 2 200                  | 0.925            |
| 2 400                  | 0.82             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 607   |
| Annealing Point AP (°C)                                          | 635   |
| Transformation Temperature Tg (°C)                               | 654   |
| Yield Point At (°C)                                              | 697   |
| Softening Point SP (°C)                                          | 737   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 73    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 86    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.773 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 61                                             |
| -90 ~ -80                               | 62                                             |
| -80 ~ -70                               | 63                                             |
| -70 ~ -60                               | 65                                             |
| -60 ~ -50                               | 66                                             |
| -50 ~ -40                               | 67                                             |
| -40 ~ -30                               | 68                                             |
| -30 ~ -20                               | 69                                             |
| -20 ~ -10                               | 69                                             |
| -10 ~ 0                                 | 70                                             |
| 0 ~ 10                                  | 71                                             |
| 10 ~ 20                                 | 72                                             |
| 20 ~ 30                                 | 73                                             |
| 30 ~ 40                                 | 74                                             |
| 40 ~ 50                                 | 75                                             |
| 50 ~ 60                                 | 76                                             |
| 60 ~ 70                                 | 77                                             |
| 70 ~ 80                                 | 78                                             |
| 80 ~ 90                                 | 78                                             |
| 90 ~ 100                                | 79                                             |
| 100 ~ 110                               | 80                                             |
| 110 ~ 120                               | 81                                             |
| 120 ~ 130                               | 82                                             |
| 130 ~ 140                               | 82                                             |
| 140 ~ 150                               | 83                                             |
| 150 ~ 160                               | 84                                             |
| 160 ~ 170                               | 85                                             |
| 170 ~ 180                               | 85                                             |
| 180 ~ 190                               | 86                                             |
| 190 ~ 200                               | 87                                             |
| 200 ~ 210                               | 87                                             |
| 210 ~ 220                               | 88                                             |
| 220 ~ 230                               | 88                                             |
| 230 ~ 240                               | 89                                             |
| 240 ~ 250                               | 90                                             |
| 250 ~ 260                               | 90                                             |
| 260 ~ 270                               | 91                                             |
| 270 ~ 280                               | 91                                             |
| 280 ~ 290                               | 92                                             |
| 290 ~ 300                               | 92                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.81 |
| Specific Gravity $d$                                     | 3.74 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 0.8                                                             | 0.9 | 1.2 | 1.3 | 1.3 | 1.4 | 1.6 | 1.8 | 2.0 | 2.3 | 2.6 | 3.4 |
| -60 ~ -40                                    | 0.7                                                             | 0.8 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.8 | 1.8 | 2.2 | 2.5 | 3.3 |
| -40 ~ -20                                    | 0.7                                                             | 0.8 | 1.1 | 1.2 | 1.2 | 1.3 | 1.5 | 1.9 | 1.9 | 2.3 | 2.6 | 3.3 |
| -20 ~ 0                                      | 0.8                                                             | 0.9 | 1.2 | 1.3 | 1.3 | 1.4 | 1.6 | 1.9 | 1.9 | 2.4 | 2.8 | 3.5 |
| 0 ~ 20                                       | 0.8                                                             | 1.0 | 1.2 | 1.3 | 1.4 | 1.5 | 1.8 | 2.1 | 2.1 | 2.5 | 2.9 | 3.7 |
| 20 ~ 40                                      | 0.9                                                             | 1.1 | 1.4 | 1.5 | 1.5 | 1.7 | 1.8 | 2.2 | 2.3 | 2.7 | 3.1 | 3.9 |
| 40 ~ 60                                      | 1.0                                                             | 1.2 | 1.6 | 1.7 | 1.7 | 1.9 | 2.0 | 2.4 | 2.4 | 2.8 | 3.3 | 4.1 |
| 60 ~ 80                                      | 1.2                                                             | 1.3 | 1.7 | 1.8 | 1.8 | 2.0 | 2.1 | 2.5 | 2.5 | 3.0 | 3.5 | 4.4 |
| 80 ~ 100                                     | 1.3                                                             | 1.5 | 1.8 | 1.9 | 2.0 | 2.1 | 2.3 | 2.7 | 2.7 | 3.2 | 3.6 | 4.5 |
| 100 ~ 120                                    | 1.4                                                             | 1.6 | 1.9 | 2.0 | 2.1 | 2.3 | 2.4 | 2.8 | 2.9 | 3.3 | 3.8 | 4.7 |
| 120 ~ 140                                    | 1.5                                                             | 1.7 | 2.0 | 2.2 | 2.2 | 2.4 | 2.6 | 3.0 | 3.0 | 3.5 | 4.0 | 5.0 |
| 140 ~ 160                                    | 1.6                                                             | 1.7 | 2.1 | 2.2 | 2.3 | 2.4 | 2.6 | 3.1 | 3.1 | 3.7 | 4.2 | 5.1 |
| 160 ~ 180                                    | 1.7                                                             | 1.9 | 2.2 | 2.4 | 2.4 | 2.6 | 2.8 | 3.2 | 3.3 | 3.7 | 4.3 | 5.2 |

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## S-BSM81

Code(d) 640601

Code(e) 643599

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.640 00<br>1.639 999 | Abbe Number $\nu_d$ | 60.08 | Dispersion $n_F - n_C$       | 0.010 653 |
| Refractive Index $n_e$ | 1.642 540             | Abbe Number $\nu_e$ | 59.88 | Dispersion $n_{F'} - n_{C'}$ | 0.010 730 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.603 85 |
| $n_{1970}$         | 1.970 09  | 1.611 38 |
| $n_{1530}$         | 1.529 58  | 1.619 17 |
| $n_{1129}$         | 1.128 64  | 1.625 55 |
| $n_t$              | 1.013 98  | 1.627 52 |
| $n_s$              | 0.852 11  | 1.630 78 |
| $n_{A'}$           | 0.768 19  | 1.632 93 |
| $n_F$              | 0.706 52  | 1.634 84 |
| $n_C$              | 0.656 27  | 1.636 73 |
| $n_{C'}$           | 0.643 85  | 1.637 25 |
| $n_{He-Ne}$        | 0.632 8   | 1.637 74 |
| $n_D$              | 0.589 29  | 1.639 90 |
| $n_d$              | 0.587 56  | 1.640 00 |
| $n_e$              | 0.546 07  | 1.642 54 |
| $n_F$              | 0.486 13  | 1.647 38 |
| $n_{F'}$           | 0.479 99  | 1.647 98 |
| $n_{He-Cd}$        | 0.441 57  | 1.652 35 |
| $n_g$              | 0.435 835 | 1.653 10 |
| $n_h$              | 0.404 656 | 1.657 83 |
| $n_i$              | 0.365 015 | 1.665 86 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.963 568 44E-01 |
| $A_2$                           | 6.513 928 37E-01 |
| $A_3$                           | 1.224 326 22E+00 |
| $B_1$                           | 1.448 215 87E-02 |
| $B_2$                           | 1.548 263 89E-03 |
| $B_3$                           | 8.998 186 04E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 4    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 53.0 |
| Phosphate Resistance PR                   | 4.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 105.7 |
| Rigidity Modulus G (GPa) | 41.6  |
| Poisson's Ratio $\sigma$ | 0.271 |
| Knoop Hardness Hk[Class] | 660 7 |
| Abrasion Aa              | 81    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.009 210 |
| $n_C - n_{A'}$      | 0.003 802 |
| $n_d - n_C$         | 0.003 271 |
| $n_e - n_C$         | 0.005 812 |
| $n_g - n_d$         | 0.013 103 |
| $n_g - n_F$         | 0.005 721 |
| $n_h - n_g$         | 0.004 730 |
| $n_i - n_g$         | 0.012 761 |
| $n_{C'} - n_t$      | 0.009 734 |
| $n_e - n_{C'}$      | 0.005 288 |
| $n_{F'} - n_e$      | 0.005 442 |
| $n_i - n_{F'}$      | 0.017 881 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.864 5 |
| $\theta_{C,A'}$              | 0.356 9 |
| $\theta_{d,C}$               | 0.307 0 |
| $\theta_{e,C}$               | 0.545 6 |
| $\theta_{g,d}$               | 1.230 0 |
| $\theta_{g,F}$               | 0.537 0 |
| $\theta_{h,g}$               | 0.444 0 |
| $\theta_{i,g}$               | 1.197 9 |
| $\theta'_{C,t}$              | 0.907 2 |
| $\theta'_{e,C'}$             | 0.492 8 |
| $\theta'_{F,e}$              | 0.507 2 |
| $\theta'_{i,F'}$             | 1.666 4 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.035 9  |
| $\Delta\theta_{C,A'}$ | 0.008 2  |
| $\Delta\theta_{g,d}$  | -0.010 0 |
| $\Delta\theta_{g,F}$  | -0.007 3 |
| $\Delta\theta_{i,g}$  | -0.024 0 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 370  | $\lambda_5$      | 305 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 358  | $\lambda_{0.05}$ | 303 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.55 | 0.49             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    | 0.01             |
| 300                    | 0.03             |
| 310                    | 0.10             |
| 320                    | 0.21             |
| 330                    | 0.38             |
| 340                    | 0.56             |
| 350                    | 0.71             |
| 360                    | 0.82             |
| 370                    | 0.89             |
| 380                    | 0.934            |
| 390                    | 0.957            |
| 400                    | 0.970            |
| 420                    | 0.981            |
| 440                    | 0.985            |
| 460                    | 0.989            |
| 480                    | 0.992            |
| 500                    | 0.995            |
| 550                    | 0.995            |
| 600                    | 0.992            |
| 650                    | 0.993            |
| 700                    | 0.995            |
| 800                    | 0.997            |
| 900                    | 0.997            |
| 1 000                  | 0.996            |
| 1 200                  | 0.996            |
| 1 400                  | 0.993            |
| 1 600                  | 0.994            |
| 1 800                  | 0.985            |
| 2 000                  | 0.961            |
| 2 200                  | 0.87             |
| 2 400                  | 0.61             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 604  |
| Annealing Point AP (°C)                                          | 624  |
| Transformation Temperature Tg (°C)                               | 662  |
| Yield Point At (°C)                                              | 688  |
| Softening Point SP (°C)                                          | 721  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 58   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 73   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.00 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 44                                             |
| -90 ~ -80                               | 45                                             |
| -80 ~ -70                               | 47                                             |
| -70 ~ -60                               | 48                                             |
| -60 ~ -50                               | 49                                             |
| -50 ~ -40                               | 51                                             |
| -40 ~ -30                               | 52                                             |
| -30 ~ -20                               | 53                                             |
| -20 ~ -10                               | 54                                             |
| -10 ~ 0                                 | 55                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 60                                             |
| 40 ~ 50                                 | 61                                             |
| 50 ~ 60                                 | 62                                             |
| 60 ~ 70                                 | 63                                             |
| 70 ~ 80                                 | 64                                             |
| 80 ~ 90                                 | 65                                             |
| 90 ~ 100                                | 66                                             |
| 100 ~ 110                               | 67                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 69                                             |
| 140 ~ 150                               | 70                                             |
| 150 ~ 160                               | 71                                             |
| 160 ~ 170                               | 71                                             |
| 170 ~ 180                               | 72                                             |
| 180 ~ 190                               | 73                                             |
| 190 ~ 200                               | 73                                             |
| 200 ~ 210                               | 74                                             |
| 210 ~ 220                               | 75                                             |
| 220 ~ 230                               | 75                                             |
| 230 ~ 240                               | 76                                             |
| 240 ~ 250                               | 76                                             |
| 250 ~ 260                               | 77                                             |
| 260 ~ 270                               | 77                                             |
| 270 ~ 280                               | 78                                             |
| 280 ~ 290                               | 78                                             |
| 290 ~ 300                               | 79                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.00 |
| Specific Gravity $d$                                     | 3.06 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.3                                                             | 2.4 | 2.6 | 2.7 | 2.7 | 2.8 | 2.9 | 3.1 | 3.2 | 3.4 | 3.7 | 4.2 |
| -60 ~ -40                                    | 2.2                                                             | 2.3 | 2.5 | 2.5 | 2.6 | 2.7 | 2.7 | 3.0 | 3.1 | 3.3 | 3.6 | 4.1 |
| -40 ~ -20                                    | 2.3                                                             | 2.4 | 2.5 | 2.6 | 2.6 | 2.7 | 2.8 | 3.1 | 3.1 | 3.4 | 3.6 | 4.2 |
| -20 ~ 0                                      | 2.4                                                             | 2.5 | 2.6 | 2.7 | 2.7 | 2.8 | 2.9 | 3.1 | 3.2 | 3.4 | 3.8 | 4.3 |
| 0 ~ 20                                       | 2.5                                                             | 2.5 | 2.7 | 2.8 | 2.8 | 2.9 | 3.0 | 3.3 | 3.4 | 3.6 | 3.9 | 4.5 |
| 20 ~ 40                                      | 2.6                                                             | 2.7 | 2.9 | 2.9 | 3.0 | 3.1 | 3.2 | 3.4 | 3.4 | 3.8 | 4.1 | 4.7 |
| 40 ~ 60                                      | 2.7                                                             | 2.8 | 3.1 | 3.2 | 3.2 | 3.3 | 3.4 | 3.6 | 3.7 | 3.9 | 4.2 | 4.8 |
| 60 ~ 80                                      | 2.9                                                             | 3.0 | 3.2 | 3.3 | 3.3 | 3.4 | 3.5 | 3.7 | 3.8 | 4.1 | 4.5 | 5.0 |
| 80 ~ 100                                     | 3.0                                                             | 3.2 | 3.4 | 3.4 | 3.5 | 3.6 | 3.7 | 3.9 | 3.9 | 4.2 | 4.5 | 5.2 |
| 100 ~ 120                                    | 3.2                                                             | 3.3 | 3.5 | 3.6 | 3.6 | 3.7 | 3.8 | 4.1 | 4.1 | 4.4 | 4.7 | 5.3 |
| 120 ~ 140                                    | 3.3                                                             | 3.4 | 3.6 | 3.7 | 3.7 | 3.8 | 3.9 | 4.2 | 4.2 | 4.5 | 4.8 | 5.4 |
| 140 ~ 160                                    | 3.3                                                             | 3.5 | 3.7 | 3.7 | 3.8 | 3.9 | 4.0 | 4.4 | 4.3 | 4.7 | 5.0 | 5.7 |
| 160 ~ 180                                    | 3.4                                                             | 3.6 | 3.8 | 3.9 | 3.9 | 4.0 | 4.1 | 4.4 | 4.4 | 4.7 | 5.1 | 5.7 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.497 00<br>1.496 999 | Abbe Number $\nu_d$ | 81.54 | Dispersion $n_F - n_C$       | 0.006 095 |
| Refractive Index $n_e$ | 1.498 455             | Abbe Number $\nu_e$ | 81.14 | Dispersion $n_{F'} - n_{C'}$ | 0.006 143 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.479 52 |
| $n_{1970}$         | 1.970 09  | 1.482 69 |
| $n_{1530}$         | 1.529 58  | 1.486 10 |
| $n_{1129}$         | 1.128 64  | 1.489 11 |
| $n_t$              | 1.013 98  | 1.490 10 |
| $n_s$              | 0.852 11  | 1.491 83 |
| $n_{A'}$           | 0.768 19  | 1.493 00 |
| $n_F$              | 0.706 52  | 1.494 07 |
| $n_C$              | 0.656 27  | 1.495 14 |
| $n_{C'}$           | 0.643 85  | 1.495 43 |
| $n_{He-Ne}$        | 0.632 8   | 1.495 71 |
| $n_D$              | 0.589 29  | 1.496 94 |
| $n_d$              | 0.587 56  | 1.497 00 |
| $n_e$              | 0.546 07  | 1.498 45 |
| $n_F$              | 0.486 13  | 1.501 23 |
| $n_{F'}$           | 0.479 99  | 1.501 58 |
| $n_{He-Cd}$        | 0.441 57  | 1.504 07 |
| $n_g$              | 0.435 835 | 1.504 51 |
| $n_h$              | 0.404 656 | 1.507 20 |
| $n_i$              | 0.365 015 | 1.511 76 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.170 105 05E+00 |
| $A_2$                           | 4.757 107 83E-02 |
| $A_3$                           | 7.638 324 45E-01 |
| $B_1$                           | 6.162 039 24E-03 |
| $B_2$                           | 2.633 728 76E-02 |
| $B_3$                           | 1.418 826 42E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 52.1 |
| Phosphate Resistance PR                   | 4.0  |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 72.7  |   |
| Rigidity Modulus G (GPa) | 28.0  |   |
| Poisson's Ratio $\sigma$ | 0.299 |   |
| Knoop Hardness Hk[Class] | 360   | 4 |
| Abrasion Aa              | 493   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.005 033 |
| $n_C - n_{A'}$      | 0.002 134 |
| $n_d - n_C$         | 0.001 863 |
| $n_e - n_C$         | 0.003 319 |
| $n_g - n_d$         | 0.007 508 |
| $n_g - n_F$         | 0.003 276 |
| $n_h - n_g$         | 0.002 698 |
| $n_i - n_g$         | 0.007 253 |
| $n_{C'} - n_t$      | 0.005 330 |
| $n_e - n_{C'}$      | 0.003 022 |
| $n_{F'} - n_e$      | 0.003 121 |
| $n_i - n_{F'}$      | 0.010 184 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.825 8 |
| $\theta_{C,A'}$              | 0.350 1 |
| $\theta_{d,C}$               | 0.305 7 |
| $\theta_{e,C}$               | 0.544 5 |
| $\theta_{g,d}$               | 1.231 8 |
| $\theta_{g,F}$               | 0.537 5 |
| $\theta_{h,g}$               | 0.442 7 |
| $\theta_{i,g}$               | 1.190 0 |
| $\theta'_{C,t}$              | 0.867 7 |
| $\theta'_{e,C'}$             | 0.491 9 |
| $\theta'_{F,e}$              | 0.508 1 |
| $\theta'_{i,F'}$             | 1.657 8 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.103 5 |
| $\Delta\theta_{C,A'}$ | -0.024 6 |
| $\Delta\theta_{g,d}$  | 0.036 4  |
| $\Delta\theta_{g,F}$  | 0.028 0  |
| $\Delta\theta_{i,g}$  | 0.147 8  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 340  | $\lambda_5$      | 290 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 333  | $\lambda_{0.05}$ | 290 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.16 | 0.13             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.01             |
| 290                    | 0.05             |
| 300                    | 0.17             |
| 310                    | 0.37             |
| 320                    | 0.60             |
| 330                    | 0.77             |
| 340                    | 0.88             |
| 350                    | 0.947            |
| 360                    | 0.975            |
| 370                    | 0.988            |
| 380                    | 0.994            |
| 390                    | 0.996            |
| 400                    | 0.995            |
| 420                    | 0.994            |
| 440                    | 0.994            |
| 460                    | 0.996            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.999            |
| 1 800                  | 0.999            |
| 2 000                  | 0.999            |
| 2 200                  | 0.997            |
| 2 400                  | 0.996            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 459   |
| Yield Point At (°C)                                              | 488   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 133   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 157   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.780 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 110                                            |
| -90 ~ -80                               | 112                                            |
| -80 ~ -70                               | 114                                            |
| -70 ~ -60                               | 116                                            |
| -60 ~ -50                               | 118                                            |
| -50 ~ -40                               | 120                                            |
| -40 ~ -30                               | 122                                            |
| -30 ~ -20                               | 124                                            |
| -20 ~ -10                               | 126                                            |
| -10 ~ 0                                 | 128                                            |
| 0 ~ 10                                  | 130                                            |
| 10 ~ 20                                 | 131                                            |
| 20 ~ 30                                 | 133                                            |
| 30 ~ 40                                 | 135                                            |
| 40 ~ 50                                 | 137                                            |
| 50 ~ 60                                 | 138                                            |
| 60 ~ 70                                 | 140                                            |
| 70 ~ 80                                 | 141                                            |
| 80 ~ 90                                 | 143                                            |
| 90 ~ 100                                | 145                                            |
| 100 ~ 110                               | 146                                            |
| 110 ~ 120                               | 147                                            |
| 120 ~ 130                               | 149                                            |
| 130 ~ 140                               | 150                                            |
| 140 ~ 150                               | 151                                            |
| 150 ~ 160                               | 153                                            |
| 160 ~ 170                               | 154                                            |
| 170 ~ 180                               | 155                                            |
| 180 ~ 190                               | 156                                            |
| 190 ~ 200                               | 158                                            |
| 200 ~ 210                               | 159                                            |
| 210 ~ 220                               | 160                                            |
| 220 ~ 230                               | 161                                            |
| 230 ~ 240                               | 162                                            |
| 240 ~ 250                               | 163                                            |
| 250 ~ 260                               | 164                                            |
| 260 ~ 270                               | 165                                            |
| 270 ~ 280                               | 165                                            |
| 280 ~ 290                               | 166                                            |
| 290 ~ 300                               | 167                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 0.74 |
| Specific Gravity $d$                                     | 3.62 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |      |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | -5.3                                                            | -5.3 | -5.2 | -5.2 | -5.2 | -5.1 | -5.1 | -4.9 | -4.9 | -4.7 | -4.6 | -4.3 |
| -60 ~ -40                                    | -5.7                                                            | -5.7 | -5.6 | -5.6 | -5.6 | -5.5 | -5.5 | -5.3 | -5.3 | -5.1 | -5.0 | -4.7 |
| -40 ~ -20                                    | -6.0                                                            | -6.0 | -5.9 | -5.9 | -5.9 | -5.8 | -5.8 | -5.5 | -5.5 | -5.4 | -5.2 | -5.0 |
| -20 ~ 0                                      | -6.2                                                            | -6.2 | -6.1 | -6.1 | -6.1 | -6.0 | -6.0 | -5.8 | -5.7 | -5.6 | -5.4 | -5.2 |
| 0 ~ 20                                       | -6.4                                                            | -6.4 | -6.3 | -6.2 | -6.2 | -6.2 | -6.1 | -6.0 | -6.0 | -5.8 | -5.7 | -5.3 |
| 20 ~ 40                                      | -6.5                                                            | -6.5 | -6.4 | -6.4 | -6.4 | -6.3 | -6.2 | -6.1 | -6.1 | -5.9 | -5.8 | -5.4 |
| 40 ~ 60                                      | -6.7                                                            | -6.7 | -6.6 | -6.5 | -6.4 | -6.3 | -6.3 | -6.2 | -6.1 | -6.0 | -5.8 | -5.5 |
| 60 ~ 80                                      | -6.8                                                            | -6.7 | -6.6 | -6.6 | -6.6 | -6.5 | -6.5 | -6.3 | -6.3 | -6.1 | -6.0 | -5.6 |
| 80 ~ 100                                     | -6.9                                                            | -6.8 | -6.7 | -6.7 | -6.7 | -6.6 | -6.5 | -6.4 | -6.4 | -6.2 | -6.0 | -5.7 |
| 100 ~ 120                                    | -6.9                                                            | -6.9 | -6.8 | -6.8 | -6.7 | -6.7 | -6.6 | -6.5 | -6.5 | -6.3 | -6.1 | -5.8 |
| 120 ~ 140                                    | -7.1                                                            | -7.0 | -6.9 | -6.9 | -6.9 | -6.8 | -6.7 | -6.6 | -6.6 | -6.3 | -6.1 | -5.8 |
| 140 ~ 160                                    | -7.1                                                            | -7.1 | -6.9 | -6.9 | -6.9 | -6.8 | -6.7 | -6.6 | -6.6 | -6.4 | -6.2 | -5.9 |
| 160 ~ 180                                    | -7.2                                                            | -7.2 | -7.1 | -7.0 | -7.0 | -6.9 | -6.9 | -6.7 | -6.7 | -6.5 | -6.4 | -6.0 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.438 75<br>1.438 750 | Abbe Number $\nu_d$ | 94.93 | Dispersion $n_F - n_C$       | 0.004 622 |
| Refractive Index $n_e$ | 1.439 854             | Abbe Number $\nu_e$ | 94.49 | Dispersion $n_{F'} - n_{C'}$ | 0.004 655 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.425 12 |
| $n_{1970}$         | 1.970 09  | 1.427 62 |
| $n_{1530}$         | 1.529 58  | 1.430 32 |
| $n_{1129}$         | 1.128 64  | 1.432 69 |
| $n_t$              | 1.013 98  | 1.433 46 |
| $n_s$              | 0.852 11  | 1.434 80 |
| $n_{A'}$           | 0.768 19  | 1.435 70 |
| $n_F$              | 0.706 52  | 1.436 52 |
| $n_C$              | 0.656 27  | 1.437 33 |
| $n_{C'}$           | 0.643 85  | 1.437 56 |
| $n_{He-Ne}$        | 0.632 8   | 1.437 77 |
| $n_D$              | 0.589 29  | 1.438 71 |
| $n_d$              | 0.587 56  | 1.438 75 |
| $n_e$              | 0.546 07  | 1.439 85 |
| $n_F$              | 0.486 13  | 1.441 95 |
| $n_{F'}$           | 0.479 99  | 1.442 21 |
| $n_{He-Cd}$        | 0.441 57  | 1.444 10 |
| $n_g$              | 0.435 835 | 1.444 42 |
| $n_h$              | 0.404 656 | 1.446 45 |
| $n_i$              | 0.365 015 | 1.449 86 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.835 323 27E-01 |
| $A_2$                           | 6.956 881 40E-02 |
| $A_3$                           | 1.114 092 38E+00 |
| $B_1$                           | 4.922 349 55E-03 |
| $B_2$                           | 1.935 810 91E-02 |
| $B_3$                           | 2.642 752 94E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 2    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 52.3 |
| Phosphate Resistance PR                   | 4.3  |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 69.1  |   |
| Rigidity Modulus G (GPa) | 26.5  |   |
| Poisson's Ratio $\sigma$ | 0.303 |   |
| Knoop Hardness Hk[Class] | 330   | 3 |
| Abrasion Aa              | 480   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.003 870 |
| $n_C - n_{A'}$      | 0.001 631 |
| $n_d - n_C$         | 0.001 417 |
| $n_e - n_C$         | 0.002 521 |
| $n_g - n_d$         | 0.005 673 |
| $n_g - n_F$         | 0.002 468 |
| $n_h - n_g$         | 0.002 028 |
| $n_i - n_g$         | 0.005 437 |
| $n_{C'} - n_t$      | 0.004 097 |
| $n_e - n_{C'}$      | 0.002 294 |
| $n_{F'} - n_e$      | 0.002 361 |
| $n_i - n_{F'}$      | 0.007 645 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.837 3 |
| $\theta_{C,A'}$              | 0.352 9 |
| $\theta_{d,C}$               | 0.306 6 |
| $\theta_{e,C}$               | 0.545 4 |
| $\theta_{g,d}$               | 1.227 4 |
| $\theta_{g,F}$               | 0.534 0 |
| $\theta_{h,g}$               | 0.438 8 |
| $\theta_{i,g}$               | 1.176 3 |
| $\theta'_{C,t}$              | 0.880 1 |
| $\theta'_{e,C'}$             | 0.492 8 |
| $\theta'_{F,e}$              | 0.507 2 |
| $\theta'_{i,F'}$             | 1.642 3 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.154 8 |
| $\Delta\theta_{C,A'}$ | -0.038 1 |
| $\Delta\theta_{g,d}$  | 0.059 8  |
| $\Delta\theta_{g,F}$  | 0.046 1  |
| $\Delta\theta_{i,g}$  | 0.246 2  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 330  | $\lambda_5$      |     |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 324  | $\lambda_{0.05}$ | 276 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.06 | 0.04             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.09             |
| 290                    | 0.21             |
| 300                    | 0.39             |
| 310                    | 0.59             |
| 320                    | 0.76             |
| 330                    | 0.87             |
| 340                    | 0.943            |
| 350                    | 0.973            |
| 360                    | 0.987            |
| 370                    | 0.994            |
| 380                    | 0.997            |
| 390                    | 0.998            |
| 400                    | 0.998            |
| 420                    | 0.997            |
| 440                    | 0.997            |
| 460                    | 0.998            |
| 480                    | 0.998            |
| 500                    | 0.999            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.998            |
| 1 600                  | 0.998            |
| 1 800                  | 0.998            |
| 2 000                  | 0.998            |
| 2 200                  | 0.997            |
| 2 400                  | 0.997            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 428   |
| Yield Point At (°C)                                              | 456   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 143   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 171   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.857 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 116                                            |
| -90 ~ -80                               | 119                                            |
| -80 ~ -70                               | 121                                            |
| -70 ~ -60                               | 124                                            |
| -60 ~ -50                               | 126                                            |
| -50 ~ -40                               | 128                                            |
| -40 ~ -30                               | 131                                            |
| -30 ~ -20                               | 133                                            |
| -20 ~ -10                               | 135                                            |
| -10 ~ 0                                 | 138                                            |
| 0 ~ 10                                  | 140                                            |
| 10 ~ 20                                 | 142                                            |
| 20 ~ 30                                 | 144                                            |
| 30 ~ 40                                 | 146                                            |
| 40 ~ 50                                 | 148                                            |
| 50 ~ 60                                 | 150                                            |
| 60 ~ 70                                 | 152                                            |
| 70 ~ 80                                 | 153                                            |
| 80 ~ 90                                 | 155                                            |
| 90 ~ 100                                | 157                                            |
| 100 ~ 110                               | 159                                            |
| 110 ~ 120                               | 160                                            |
| 120 ~ 130                               | 162                                            |
| 130 ~ 140                               | 163                                            |
| 140 ~ 150                               | 165                                            |
| 150 ~ 160                               | 166                                            |
| 160 ~ 170                               | 168                                            |
| 170 ~ 180                               | 169                                            |
| 180 ~ 190                               | 170                                            |
| 190 ~ 200                               | 172                                            |
| 200 ~ 210                               | 173                                            |
| 210 ~ 220                               | 174                                            |
| 220 ~ 230                               | 175                                            |
| 230 ~ 240                               | 176                                            |
| 240 ~ 250                               | 177                                            |
| 250 ~ 260                               | 178                                            |
| 260 ~ 270                               | 179                                            |
| 270 ~ 280                               | 180                                            |
| 280 ~ 290                               | 181                                            |
| 290 ~ 300                               | 181                                            |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 0.57 |
| Specific Gravity $d$                        | 3.62 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |      |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | -5.3                                                            | -5.3 | -5.2 | -5.2 | -5.2 | -5.1 | -5.1 | -5.0 | -5.0 | -4.9 | -4.7 | -4.5 |
| -60 ~ -40                                    | -5.8                                                            | -5.8 | -5.7 | -5.7 | -5.7 | -5.6 | -5.6 | -5.5 | -5.5 | -5.3 | -5.2 | -5.0 |
| -40 ~ -20                                    | -6.2                                                            | -6.2 | -6.1 | -6.1 | -6.0 | -5.9 | -5.9 | -5.8 | -5.8 | -5.7 | -5.6 | -5.4 |
| -20 ~ 0                                      | -6.5                                                            | -6.5 | -6.3 | -6.3 | -6.3 | -6.2 | -6.2 | -6.1 | -6.1 | -6.0 | -5.9 | -5.7 |
| 0 ~ 20                                       | -6.7                                                            | -6.7 | -6.6 | -6.6 | -6.6 | -6.5 | -6.5 | -6.4 | -6.4 | -6.2 | -6.1 | -5.9 |
| 20 ~ 40                                      | -6.9                                                            | -6.9 | -6.8 | -6.7 | -6.7 | -6.7 | -6.6 | -6.5 | -6.5 | -6.4 | -6.3 | -6.1 |
| 40 ~ 60                                      | -7.1                                                            | -7.1 | -7.0 | -7.0 | -6.9 | -6.9 | -6.9 | -6.8 | -6.8 | -6.6 | -6.5 | -6.3 |
| 60 ~ 80                                      | -7.2                                                            | -7.2 | -7.1 | -7.0 | -7.0 | -7.0 | -7.0 | -6.9 | -6.8 | -6.7 | -6.6 | -6.4 |
| 80 ~ 100                                     | -7.3                                                            | -7.3 | -7.2 | -7.2 | -7.2 | -7.1 | -7.1 | -7.0 | -7.0 | -6.9 | -6.8 | -6.5 |
| 100 ~ 120                                    | -7.5                                                            | -7.5 | -7.4 | -7.3 | -7.3 | -7.3 | -7.2 | -7.1 | -7.1 | -7.0 | -6.9 | -6.7 |
| 120 ~ 140                                    | -7.6                                                            | -7.6 | -7.5 | -7.5 | -7.5 | -7.4 | -7.3 | -7.3 | -7.2 | -7.1 | -7.0 | -6.8 |
| 140 ~ 160                                    | -7.8                                                            | -7.8 | -7.7 | -7.6 | -7.6 | -7.6 | -7.5 | -7.3 | -7.3 | -7.2 | -7.1 | -6.9 |
| 160 ~ 180                                    | -7.8                                                            | -7.8 | -7.7 | -7.7 | -7.7 | -7.6 | -7.6 | -7.5 | -7.5 | -7.3 | -7.2 | -7.0 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.438 75<br>1.438 750 | Abbe Number $\nu_d$ | 94.66 | Dispersion $n_F - n_C$       | 0.004 635 |
| Refractive Index $n_e$ | 1.439 857             | Abbe Number $\nu_e$ | 94.23 | Dispersion $n_{F'} - n_{C'}$ | 0.004 668 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.424 92 |
| $n_{1970}$         | 1.970 09  | 1.427 47 |
| $n_{1530}$         | 1.529 58  | 1.430 23 |
| $n_{1129}$         | 1.128 64  | 1.432 64 |
| $n_t$              | 1.013 98  | 1.433 43 |
| $n_s$              | 0.852 11  | 1.434 78 |
| $n_{A'}$           | 0.768 19  | 1.435 69 |
| $n_F$              | 0.706 52  | 1.436 51 |
| $n_C$              | 0.656 27  | 1.437 33 |
| $n_{C'}$           | 0.643 85  | 1.437 55 |
| $n_{He-Ne}$        | 0.632 8   | 1.437 77 |
| $n_D$              | 0.589 29  | 1.438 71 |
| $n_d$              | 0.587 56  | 1.438 75 |
| $n_e$              | 0.546 07  | 1.439 86 |
| $n_F$              | 0.486 13  | 1.441 96 |
| $n_{F'}$           | 0.479 99  | 1.442 22 |
| $n_{He-Cd}$        | 0.441 57  | 1.444 11 |
| $n_g$              | 0.435 835 | 1.444 44 |
| $n_h$              | 0.404 656 | 1.446 47 |
| $n_i$              | 0.365 015 | 1.449 88 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 8.390 676 82E-01  |
| $A_2$                           | 2.140 835 03E-01  |
| $A_3$                           | 1.479 146 77E+00  |
| $B_1$                           | 7.952 866 39E-03  |
| $B_2$                           | -2.325 817 17E-03 |
| $B_3$                           | 3.400 437 00E+02  |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 2    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 52.1 |
| Phosphate Resistance PR                   | 4.1  |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 69.8  |   |
| Rigidity Modulus G (GPa) | 26.8  |   |
| Poisson's Ratio $\sigma$ | 0.302 |   |
| Knoop Hardness Hk[Class] | 330   | 3 |
| Abrasion Aa              | 470   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.003 898 |
| $n_C - n_{A'}$      | 0.001 639 |
| $n_d - n_C$         | 0.001 422 |
| $n_e - n_C$         | 0.002 529 |
| $n_g - n_d$         | 0.005 688 |
| $n_g - n_F$         | 0.002 475 |
| $n_h - n_g$         | 0.002 031 |
| $n_i - n_g$         | 0.005 445 |
| $n_{C'} - n_t$      | 0.004 125 |
| $n_e - n_{C'}$      | 0.002 302 |
| $n_{F'} - n_e$      | 0.002 366 |
| $n_i - n_{F'}$      | 0.007 660 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.841 0 |
| $\theta_{C,A'}$              | 0.353 6 |
| $\theta_{d,C}$               | 0.306 8 |
| $\theta_{e,C}$               | 0.545 6 |
| $\theta_{g,d}$               | 1.227 2 |
| $\theta_{g,F}$               | 0.534 0 |
| $\theta_{h,g}$               | 0.438 2 |
| $\theta_{i,g}$               | 1.174 8 |
| $\theta'_{C,t}$              | 0.883 7 |
| $\theta'_{e,C'}$             | 0.493 1 |
| $\theta'_{F',e}$             | 0.506 9 |
| $\theta'_{i,F'}$             | 1.641 0 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.149 8 |
| $\Delta\theta_{C,A'}$ | -0.037 1 |
| $\Delta\theta_{g,d}$  | 0.059 0  |
| $\Delta\theta_{g,F}$  | 0.045 7  |
| $\Delta\theta_{i,g}$  | 0.242 4  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 330  | $\lambda_5$      |     |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 324  | $\lambda_{0.05}$ | 275 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.04 | 0.04             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.10             |
| 290                    | 0.22             |
| 300                    | 0.39             |
| 310                    | 0.59             |
| 320                    | 0.76             |
| 330                    | 0.87             |
| 340                    | 0.941            |
| 350                    | 0.972            |
| 360                    | 0.987            |
| 370                    | 0.994            |
| 380                    | 0.997            |
| 390                    | 0.998            |
| 400                    | 0.998            |
| 420                    | 0.998            |
| 440                    | 0.998            |
| 460                    | 0.998            |
| 480                    | 0.999            |
| 500                    | 0.999            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.998            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.998            |
| 1 400                  | 0.998            |
| 1 600                  | 0.998            |
| 1 800                  | 0.997            |
| 2 000                  | 0.997            |
| 2 200                  | 0.996            |
| 2 400                  | 0.996            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 439   |
| Yield Point At (°C)                                              | 462   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 141   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 168   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.876 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 115                                            |
| -90 ~ -80                               | 118                                            |
| -80 ~ -70                               | 120                                            |
| -70 ~ -60                               | 122                                            |
| -60 ~ -50                               | 125                                            |
| -50 ~ -40                               | 127                                            |
| -40 ~ -30                               | 129                                            |
| -30 ~ -20                               | 131                                            |
| -20 ~ -10                               | 133                                            |
| -10 ~ 0                                 | 135                                            |
| 0 ~ 10                                  | 138                                            |
| 10 ~ 20                                 | 140                                            |
| 20 ~ 30                                 | 142                                            |
| 30 ~ 40                                 | 143                                            |
| 40 ~ 50                                 | 145                                            |
| 50 ~ 60                                 | 147                                            |
| 60 ~ 70                                 | 149                                            |
| 70 ~ 80                                 | 151                                            |
| 80 ~ 90                                 | 152                                            |
| 90 ~ 100                                | 154                                            |
| 100 ~ 110                               | 156                                            |
| 110 ~ 120                               | 157                                            |
| 120 ~ 130                               | 159                                            |
| 130 ~ 140                               | 160                                            |
| 140 ~ 150                               | 162                                            |
| 150 ~ 160                               | 163                                            |
| 160 ~ 170                               | 165                                            |
| 170 ~ 180                               | 166                                            |
| 180 ~ 190                               | 167                                            |
| 190 ~ 200                               | 168                                            |
| 200 ~ 210                               | 170                                            |
| 210 ~ 220                               | 171                                            |
| 220 ~ 230                               | 172                                            |
| 230 ~ 240                               | 173                                            |
| 240 ~ 250                               | 174                                            |
| 250 ~ 260                               | 175                                            |
| 260 ~ 270                               | 176                                            |
| 270 ~ 280                               | 177                                            |
| 280 ~ 290                               | 178                                            |
| 290 ~ 300                               | 179                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 0.59 |
| Specific Gravity $d$                                     | 3.59 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |      |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | -5.0                                                            | -4.9 | -4.8 | -4.8 | -4.8 | -4.8 | -4.8 | -4.7 | -4.7 | -4.5 | -4.4 | -4.3 |
| -60 ~ -40                                    | -5.4                                                            | -5.4 | -5.4 | -5.3 | -5.3 | -5.3 | -5.3 | -5.2 | -5.2 | -5.0 | -4.9 | -4.8 |
| -40 ~ -20                                    | -5.9                                                            | -5.9 | -5.8 | -5.8 | -5.7 | -5.7 | -5.6 | -5.5 | -5.5 | -5.4 | -5.3 | -5.2 |
| -20 ~ 0                                      | -6.2                                                            | -6.2 | -6.0 | -6.0 | -6.0 | -5.9 | -5.9 | -5.8 | -5.8 | -5.7 | -5.6 | -5.4 |
| 0 ~ 20                                       | -6.5                                                            | -6.4 | -6.4 | -6.3 | -6.3 | -6.3 | -6.2 | -6.1 | -6.1 | -5.9 | -5.8 | -5.6 |
| 20 ~ 40                                      | -6.7                                                            | -6.7 | -6.6 | -6.5 | -6.5 | -6.4 | -6.4 | -6.3 | -6.2 | -6.1 | -6.0 | -5.8 |
| 40 ~ 60                                      | -6.8                                                            | -6.8 | -6.7 | -6.7 | -6.7 | -6.6 | -6.6 | -6.4 | -6.4 | -6.3 | -6.2 | -6.0 |
| 60 ~ 80                                      | -7.0                                                            | -6.9 | -6.8 | -6.8 | -6.8 | -6.7 | -6.7 | -6.6 | -6.5 | -6.4 | -6.3 | -6.1 |
| 80 ~ 100                                     | -7.1                                                            | -7.1 | -7.0 | -6.9 | -6.9 | -6.9 | -6.8 | -6.7 | -6.7 | -6.5 | -6.4 | -6.1 |
| 100 ~ 120                                    | -7.3                                                            | -7.2 | -7.1 | -7.1 | -7.1 | -7.0 | -6.9 | -6.8 | -6.8 | -6.6 | -6.5 | -6.2 |
| 120 ~ 140                                    | -7.4                                                            | -7.3 | -7.2 | -7.2 | -7.2 | -7.1 | -7.0 | -6.9 | -6.9 | -6.7 | -6.6 | -6.3 |
| 140 ~ 160                                    | -7.6                                                            | -7.5 | -7.4 | -7.3 | -7.3 | -7.3 | -7.2 | -6.9 | -6.9 | -6.7 | -6.6 | -6.3 |
| 160 ~ 180                                    | -7.6                                                            | -7.5 | -7.4 | -7.4 | -7.3 | -7.3 | -7.2 | -7.0 | -7.0 | -6.8 | -6.7 | -6.4 |

## S-FPM 2

Code(d) **595677**  
Code(e) **597674**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.595 22</b><br>1.595 220 | Abbe Number $\nu_d$ | <b>67.74</b> | Dispersion $n_F - n_C$       | <b>0.008 787</b> |
| Refractive Index $n_e$ | 1.597 316                    | Abbe Number $\nu_e$ | 67.37        | Dispersion $n_{F'} - n_{C'}$ | 0.008 866        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.572 52 |
| $n_{1970}$         | 1.970 09  | 1.576 31 |
| $n_{1530}$         | 1.529 58  | 1.580 45 |
| $n_{1129}$         | 1.128 64  | 1.584 26 |
| $n_t$              | 1.013 98  | 1.585 57 |
| $n_s$              | 0.852 11  | 1.587 91 |
| $n_{A'}$           | 0.768 19  | 1.589 54 |
| $n_F$              | 0.706 52  | 1.591 05 |
| $n_C$              | 0.656 27  | 1.592 55 |
| $n_{C'}$           | 0.643 85  | 1.592 98 |
| $n_{He-Ne}$        | 0.632 8   | 1.593 37 |
| $n_D$              | 0.589 29  | 1.595 14 |
| $n_d$              | 0.587 56  | 1.595 22 |
| $n_e$              | 0.546 07  | 1.597 32 |
| $n_F$              | 0.486 13  | 1.601 34 |
| $n_{F'}$           | 0.479 99  | 1.601 84 |
| $n_{He-Cd}$        | 0.441 57  | 1.605 49 |
| $n_g$              | 0.435 835 | 1.606 12 |
| $n_h$              | 0.404 656 | 1.610 08 |
| $n_i$              | 0.365 015 | 1.616 81 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 7.612 427 85E-01 |
| $A_2$                           | 7.470 333 75E-01 |
| $A_3$                           | 9.389 289 47E-01 |
| $B_1$                           | 3.211 740 95E-03 |
| $B_2$                           | 1.402 344 23E-02 |
| $B_3$                           | 1.395 235 30E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 1    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 51.3 |
| Phosphate Resistance PR                   | 4.1  |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 75.7  |   |
| Rigidity Modulus G (GPa) | 29.4  |   |
| Poisson's Ratio $\sigma$ | 0.287 |   |
| Knoop Hardness Hk[Class] | 400   | 4 |
| Abrasion Aa              | 521   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.006 988 |
| $n_C - n_{A'}$      | 0.003 015 |
| $n_d - n_C$         | 0.002 665 |
| $n_e - n_C$         | 0.004 761 |
| $n_g - n_d$         | 0.010 904 |
| $n_g - n_F$         | 0.004 782 |
| $n_h - n_g$         | 0.003 960 |
| $n_i - n_g$         | 0.010 681 |
| $n_{C'} - n_t$      | 0.007 411 |
| $n_e - n_{C'}$      | 0.004 338 |
| $n_{F'} - n_e$      | 0.004 528 |
| $n_i - n_{F'}$      | 0.014 961 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.795 3 |
| $\theta_{C,A'}$              | 0.343 1 |
| $\theta_{d,C}$               | 0.303 3 |
| $\theta_{e,C}$               | 0.541 8 |
| $\theta_{g,d}$               | 1.240 9 |
| $\theta_{g,F}$               | 0.544 2 |
| $\theta_{h,g}$               | 0.450 7 |
| $\theta_{i,g}$               | 1.215 5 |
| $\theta'_{C,t}$              | 0.835 9 |
| $\theta'_{e,C'}$             | 0.489 3 |
| $\theta'_{F',e}$             | 0.510 7 |
| $\theta'_{i,F'}$             | 1.687 5 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.069 2 |
| $\Delta\theta_{C,A'}$ | -0.014 9 |
| $\Delta\theta_{g,d}$  | 0.016 9  |
| $\Delta\theta_{g,F}$  | 0.012 3  |
| $\Delta\theta_{i,g}$  | 0.057 7  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 355  | $\lambda_5$      | 295 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 347  | $\lambda_{0.05}$ | 302 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.32 | 0.27             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.18             |
| 320                    | 0.35             |
| 330                    | 0.54             |
| 340                    | 0.72             |
| 350                    | 0.84             |
| 360                    | 0.917            |
| 370                    | 0.958            |
| 380                    | 0.980            |
| 390                    | 0.988            |
| 400                    | 0.991            |
| 420                    | 0.989            |
| 440                    | 0.989            |
| 460                    | 0.992            |
| 480                    | 0.994            |
| 500                    | 0.996            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.996            |
| 700                    | 0.996            |
| 800                    | 0.995            |
| 900                    | 0.995            |
| 1 000                  | 0.996            |
| 1 200                  | 0.997            |
| 1 400                  | 0.997            |
| 1 600                  | 0.997            |
| 1 800                  | 0.995            |
| 2 000                  | 0.992            |
| 2 200                  | 0.989            |
| 2 400                  | 0.983            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 569   |
| Yield Point At (°C)                                              | 594   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 117   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 137   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.624 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 100                                            |
| -90 ~ -80                               | 101                                            |
| -80 ~ -70                               | 103                                            |
| -70 ~ -60                               | 104                                            |
| -60 ~ -50                               | 106                                            |
| -50 ~ -40                               | 108                                            |
| -40 ~ -30                               | 109                                            |
| -30 ~ -20                               | 111                                            |
| -20 ~ -10                               | 112                                            |
| -10 ~ 0                                 | 113                                            |
| 0 ~ 10                                  | 115                                            |
| 10 ~ 20                                 | 116                                            |
| 20 ~ 30                                 | 118                                            |
| 30 ~ 40                                 | 119                                            |
| 40 ~ 50                                 | 120                                            |
| 50 ~ 60                                 | 122                                            |
| 60 ~ 70                                 | 123                                            |
| 70 ~ 80                                 | 124                                            |
| 80 ~ 90                                 | 125                                            |
| 90 ~ 100                                | 126                                            |
| 100 ~ 110                               | 128                                            |
| 110 ~ 120                               | 129                                            |
| 120 ~ 130                               | 130                                            |
| 130 ~ 140                               | 131                                            |
| 140 ~ 150                               | 132                                            |
| 150 ~ 160                               | 133                                            |
| 160 ~ 170                               | 134                                            |
| 170 ~ 180                               | 135                                            |
| 180 ~ 190                               | 136                                            |
| 190 ~ 200                               | 137                                            |
| 200 ~ 210                               | 138                                            |
| 210 ~ 220                               | 138                                            |
| 220 ~ 230                               | 139                                            |
| 230 ~ 240                               | 140                                            |
| 240 ~ 250                               | 141                                            |
| 250 ~ 260                               | 142                                            |
| 260 ~ 270                               | 142                                            |
| 270 ~ 280                               | 143                                            |
| 280 ~ 290                               | 144                                            |
| 290 ~ 300                               | 144                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 0.51 |
| Specific Gravity $d$                                     | 4.17 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |      |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | -5.9                                                            | -5.8 | -5.7 | -5.6 | -5.6 | -5.6 | -5.5 | -5.4 | -5.3 | -5.1 | -4.9 | -4.7 |
| -60 ~ -40                                    | -6.1                                                            | -6.1 | -5.9 | -5.8 | -5.8 | -5.7 | -5.7 | -5.5 | -5.5 | -5.3 | -5.2 | -4.8 |
| -40 ~ -20                                    | -6.2                                                            | -6.2 | -6.1 | -5.9 | -5.9 | -5.8 | -5.7 | -5.6 | -5.6 | -5.4 | -5.2 | -4.8 |
| -20 ~ 0                                      | -6.3                                                            | -6.2 | -6.1 | -6.0 | -6.0 | -5.8 | -5.8 | -5.6 | -5.6 | -5.4 | -5.2 | -4.9 |
| 0 ~ 20                                       | -6.3                                                            | -6.2 | -6.0 | -6.0 | -6.0 | -5.9 | -5.8 | -5.6 | -5.6 | -5.4 | -5.2 | -4.8 |
| 20 ~ 40                                      | -6.3                                                            | -6.2 | -6.0 | -6.0 | -6.0 | -5.9 | -5.8 | -5.6 | -5.6 | -5.4 | -5.2 | -4.7 |
| 40 ~ 60                                      | -6.3                                                            | -6.2 | -6.0 | -6.0 | -6.0 | -5.9 | -5.8 | -5.6 | -5.6 | -5.2 | -5.0 | -4.7 |
| 60 ~ 80                                      | -6.2                                                            | -6.2 | -6.0 | -5.9 | -5.9 | -5.8 | -5.7 | -5.5 | -5.5 | -5.3 | -5.0 | -4.6 |
| 80 ~ 100                                     | -6.3                                                            | -6.2 | -6.0 | -5.9 | -5.9 | -5.8 | -5.7 | -5.5 | -5.4 | -5.2 | -5.0 | -4.6 |
| 100 ~ 120                                    | -6.2                                                            | -6.2 | -6.0 | -5.9 | -5.9 | -5.8 | -5.7 | -5.4 | -5.4 | -5.2 | -4.9 | -4.5 |
| 120 ~ 140                                    | -6.3                                                            | -6.2 | -6.0 | -5.9 | -5.9 | -5.8 | -5.7 | -5.5 | -5.4 | -5.2 | -4.9 | -4.5 |
| 140 ~ 160                                    | -6.3                                                            | -6.3 | -6.0 | -6.0 | -5.9 | -5.8 | -5.7 | -5.5 | -5.5 | -5.2 | -4.9 | -4.4 |
| 160 ~ 180                                    | -6.4                                                            | -6.4 | -6.1 | -6.0 | -5.9 | -5.8 | -5.7 | -5.5 | -5.4 | -5.2 | -4.9 | -4.4 |

OHARA 25-04

S-FPM 3

Code(d) 538747  
Code(e) 539743

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.537 75<br>1.537 750 | Abbe Number $\nu_d$ | 74.70 | Dispersion $n_F - n_C$       | 0.007 199 |
| Refractive Index $n_e$ | 1.539 469             | Abbe Number $\nu_e$ | 74.34 | Dispersion $n_{F'} - n_{C'}$ | 0.007 257 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.517 38 |
| $n_{1970}$         | 1.970 09  | 1.521 05 |
| $n_{1530}$         | 1.529 58  | 1.525 00 |
| $n_{1129}$         | 1.128 64  | 1.528 49 |
| $n_t$              | 1.013 98  | 1.529 65 |
| $n_s$              | 0.852 11  | 1.531 67 |
| $n_{A'}$           | 0.768 19  | 1.533 04 |
| $n_F$              | 0.706 52  | 1.534 30 |
| $n_C$              | 0.656 27  | 1.535 55 |
| $n_{C'}$           | 0.643 85  | 1.535 90 |
| $n_{He-Ne}$        | 0.632 8   | 1.536 23 |
| $n_D$              | 0.589 29  | 1.537 69 |
| $n_d$              | 0.587 56  | 1.537 75 |
| $n_e$              | 0.546 07  | 1.539 47 |
| $n_F$              | 0.486 13  | 1.542 75 |
| $n_{F'}$           | 0.479 99  | 1.543 16 |
| $n_{He-Cd}$        | 0.441 57  | 1.546 12 |
| $n_g$              | 0.435 835 | 1.546 64 |
| $n_h$              | 0.404 656 | 1.549 84 |
| $n_i$              | 0.365 015 | 1.555 25 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 8.094 072 86E-01 |
| $A_2$                           | 5.270 070 33E-01 |
| $A_3$                           | 9.091 277 04E-01 |
| $B_1$                           | 3.760 723 89E-03 |
| $B_2$                           | 1.356 548 95E-02 |
| $B_3$                           | 1.425 036 12E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 5.1 |
| Phosphate Resistance PR                   | 4.1 |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 80.6  |   |
| Rigidity Modulus G (GPa) | 31.2  |   |
| Poisson's Ratio $\sigma$ | 0.291 |   |
| Knoop Hardness Hk[Class] | 400   | 4 |
| Abrasion Aa              | 418   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.005 905 |
| $n_C - n_{A'}$      | 0.002 510 |
| $n_d - n_C$         | 0.002 196 |
| $n_e - n_C$         | 0.003 915 |
| $n_g - n_d$         | 0.008 885 |
| $n_g - n_F$         | 0.003 882 |
| $n_h - n_g$         | 0.003 203 |
| $n_i - n_g$         | 0.008 618 |
| $n_{C'} - n_t$      | 0.006 255 |
| $n_e - n_{C'}$      | 0.003 565 |
| $n_{F'} - n_e$      | 0.003 692 |
| $n_i - n_{F'}$      | 0.012 092 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.820 3 |
| $\theta_{C,A'}$              | 0.348 7 |
| $\theta_{d,C}$               | 0.305 0 |
| $\theta_{e,C}$               | 0.543 8 |
| $\theta_{g,d}$               | 1.234 2 |
| $\theta_{g,F}$               | 0.539 2 |
| $\theta_{h,g}$               | 0.444 9 |
| $\theta_{i,g}$               | 1.197 1 |
| $\theta'_{C,t}$              | 0.861 9 |
| $\theta'_{e,C'}$             | 0.491 2 |
| $\theta'_{F,e}$              | 0.508 8 |
| $\theta'_{i,F'}$             | 1.666 3 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.076 9 |
| $\Delta\theta_{C,A'}$ | -0.017 7 |
| $\Delta\theta_{g,d}$  | 0.024 6  |
| $\Delta\theta_{g,F}$  | 0.018 6  |
| $\Delta\theta_{i,g}$  | 0.097 6  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 345  | $\lambda_5$      |     |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 336  | $\lambda_{0.05}$ | 284 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.28 | 0.23             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.03             |
| 290                    | 0.08             |
| 300                    | 0.19             |
| 310                    | 0.36             |
| 320                    | 0.55             |
| 330                    | 0.72             |
| 340                    | 0.85             |
| 350                    | 0.924            |
| 360                    | 0.962            |
| 370                    | 0.981            |
| 380                    | 0.990            |
| 390                    | 0.992            |
| 400                    | 0.992            |
| 420                    | 0.989            |
| 440                    | 0.990            |
| 460                    | 0.992            |
| 480                    | 0.995            |
| 500                    | 0.996            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.996            |
| 700                    | 0.996            |
| 800                    | 0.994            |
| 900                    | 0.995            |
| 1 000                  | 0.996            |
| 1 200                  | 0.997            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.995            |
| 2 000                  | 0.993            |
| 2 200                  | 0.987            |
| 2 400                  | 0.984            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 505   |
| Yield Point At (°C)                                              | 533   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 117   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 138   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.805 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 96                                             |
| -90 ~ -80                               | 98                                             |
| -80 ~ -70                               | 100                                            |
| -70 ~ -60                               | 102                                            |
| -60 ~ -50                               | 104                                            |
| -50 ~ -40                               | 105                                            |
| -40 ~ -30                               | 107                                            |
| -30 ~ -20                               | 109                                            |
| -20 ~ -10                               | 111                                            |
| -10 ~ 0                                 | 112                                            |
| 0 ~ 10                                  | 114                                            |
| 10 ~ 20                                 | 116                                            |
| 20 ~ 30                                 | 117                                            |
| 30 ~ 40                                 | 119                                            |
| 40 ~ 50                                 | 120                                            |
| 50 ~ 60                                 | 122                                            |
| 60 ~ 70                                 | 123                                            |
| 70 ~ 80                                 | 124                                            |
| 80 ~ 90                                 | 126                                            |
| 90 ~ 100                                | 127                                            |
| 100 ~ 110                               | 128                                            |
| 110 ~ 120                               | 130                                            |
| 120 ~ 130                               | 131                                            |
| 130 ~ 140                               | 132                                            |
| 140 ~ 150                               | 133                                            |
| 150 ~ 160                               | 134                                            |
| 160 ~ 170                               | 135                                            |
| 170 ~ 180                               | 136                                            |
| 180 ~ 190                               | 137                                            |
| 190 ~ 200                               | 138                                            |
| 200 ~ 210                               | 139                                            |
| 210 ~ 220                               | 140                                            |
| 220 ~ 230                               | 141                                            |
| 230 ~ 240                               | 142                                            |
| 240 ~ 250                               | 143                                            |
| 250 ~ 260                               | 143                                            |
| 260 ~ 270                               | 144                                            |
| 270 ~ 280                               | 145                                            |
| 280 ~ 290                               | 146                                            |
| 290 ~ 300                               | 146                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 0.85 |
| Specific Gravity $d$                                     | 3.64 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |      |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | -3.8                                                            | -3.8 | -3.6 | -3.6 | -3.6 | -3.5 | -3.5 | -3.4 | -3.4 | -3.2 | -3.0 | -2.7 |
| -60 ~ -40                                    | -4.2                                                            | -4.2 | -4.0 | -4.0 | -4.0 | -3.9 | -3.8 | -3.7 | -3.7 | -3.6 | -3.4 | -3.0 |
| -40 ~ -20                                    | -4.5                                                            | -4.4 | -4.3 | -4.2 | -4.2 | -4.2 | -4.1 | -4.0 | -3.9 | -3.8 | -3.6 | -3.2 |
| -20 ~ 0                                      | -4.7                                                            | -4.6 | -4.4 | -4.4 | -4.4 | -4.3 | -4.3 | -4.1 | -4.1 | -3.9 | -3.7 | -3.3 |
| 0 ~ 20                                       | -4.8                                                            | -4.7 | -4.6 | -4.6 | -4.6 | -4.5 | -4.4 | -4.3 | -4.2 | -4.0 | -3.8 | -3.4 |
| 20 ~ 40                                      | -4.9                                                            | -4.9 | -4.7 | -4.7 | -4.7 | -4.5 | -4.4 | -4.3 | -4.2 | -4.0 | -3.9 | -3.5 |
| 40 ~ 60                                      | -4.9                                                            | -4.9 | -4.7 | -4.7 | -4.6 | -4.6 | -4.5 | -4.3 | -4.3 | -4.1 | -3.9 | -3.5 |
| 60 ~ 80                                      | -5.0                                                            | -5.0 | -4.8 | -4.8 | -4.7 | -4.7 | -4.5 | -4.3 | -4.3 | -4.1 | -3.8 | -3.4 |
| 80 ~ 100                                     | -5.1                                                            | -5.0 | -4.8 | -4.8 | -4.8 | -4.7 | -4.6 | -4.4 | -4.4 | -4.0 | -3.8 | -3.4 |
| 100 ~ 120                                    | -5.1                                                            | -5.0 | -4.9 | -4.8 | -4.8 | -4.7 | -4.5 | -4.4 | -4.4 | -4.0 | -3.8 | -3.3 |
| 120 ~ 140                                    | -5.1                                                            | -5.1 | -4.8 | -4.7 | -4.7 | -4.6 | -4.5 | -4.3 | -4.3 | -4.0 | -3.8 | -3.3 |
| 140 ~ 160                                    | -5.1                                                            | -5.0 | -4.8 | -4.7 | -4.7 | -4.6 | -4.5 | -4.3 | -4.3 | -4.0 | -3.8 | -3.3 |
| 160 ~ 180                                    | -5.1                                                            | -5.1 | -4.9 | -4.8 | -4.8 | -4.7 | -4.6 | -4.3 | -4.3 | -4.0 | -3.8 | -3.2 |

## S-FPM 4

Code(d) 528765

Code(e) 530760

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.528 41<br>1.528 410 | Abbe Number $\nu_d$ | 76.46 | Dispersion $n_F - n_C$       | 0.006 911 |
| Refractive Index $n_e$ | 1.530 060             | Abbe Number $\nu_e$ | 76.07 | Dispersion $n_{F'} - n_{C'}$ | 0.006 968 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.509 11 |
| $n_{1970}$         | 1.970 09  | 1.512 54 |
| $n_{1530}$         | 1.529 58  | 1.516 25 |
| $n_{1129}$         | 1.128 64  | 1.519 55 |
| $n_t$              | 1.013 98  | 1.520 65 |
| $n_s$              | 0.852 11  | 1.522 58 |
| $n_{A'}$           | 0.768 19  | 1.523 90 |
| $n_F$              | 0.706 52  | 1.525 10 |
| $n_C$              | 0.656 27  | 1.526 30 |
| $n_{C'}$           | 0.643 85  | 1.526 64 |
| $n_{He-Ne}$        | 0.632 8   | 1.526 95 |
| $n_D$              | 0.589 29  | 1.528 35 |
| $n_d$              | 0.587 56  | 1.528 41 |
| $n_e$              | 0.546 07  | 1.530 06 |
| $n_F$              | 0.486 13  | 1.533 21 |
| $n_{F'}$           | 0.479 99  | 1.533 61 |
| $n_{He-Cd}$        | 0.441 57  | 1.536 45 |
| $n_g$              | 0.435 835 | 1.536 94 |
| $n_h$              | 0.404 656 | 1.540 02 |
| $n_i$              | 0.365 015 | 1.545 22 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 6.855 850 84E-01 |
| $A_2$                           | 6.233 802 15E-01 |
| $A_3$                           | 9.141 783 86E-01 |
| $B_1$                           | 2.881 720 10E-03 |
| $B_2$                           | 1.247 017 07E-02 |
| $B_3$                           | 1.535 772 00E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 51.3 |
| Phosphate Resistance PR                   | 4.3  |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 74.7  |   |
| Rigidity Modulus G (GPa) | 28.9  |   |
| Poisson's Ratio $\sigma$ | 0.295 |   |
| Knoop Hardness Hk[Class] | 380   | 4 |
| Abrasion Aa              | 506   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.005 650 |
| $n_C - n_{A'}$      | 0.002 406 |
| $n_d - n_C$         | 0.002 107 |
| $n_e - n_C$         | 0.003 757 |
| $n_g - n_d$         | 0.008 533 |
| $n_g - n_F$         | 0.003 729 |
| $n_h - n_g$         | 0.003 076 |
| $n_i - n_g$         | 0.008 275 |
| $n_{C'} - n_t$      | 0.005 985 |
| $n_e - n_{C'}$      | 0.003 422 |
| $n_{F'} - n_e$      | 0.003 546 |
| $n_i - n_{F'}$      | 0.011 612 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.817 5 |
| $\theta_{C,A'}$              | 0.348 1 |
| $\theta_{d,C}$               | 0.304 9 |
| $\theta_{e,C}$               | 0.543 6 |
| $\theta_{g,d}$               | 1.234 7 |
| $\theta_{g,F}$               | 0.539 6 |
| $\theta_{h,g}$               | 0.445 1 |
| $\theta_{i,g}$               | 1.197 4 |
| $\theta'_{C,t}$              | 0.858 9 |
| $\theta'_{e,C'}$             | 0.491 1 |
| $\theta'_{F,e}$              | 0.508 9 |
| $\theta'_{i,F'}$             | 1.666 5 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.087 9 |
| $\Delta\theta_{C,A'}$ | -0.020 5 |
| $\Delta\theta_{g,d}$  | 0.028 8  |
| $\Delta\theta_{g,F}$  | 0.021 8  |
| $\Delta\theta_{i,g}$  | 0.112 6  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 340  | $\lambda_5$      |     |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 335  | $\lambda_{0.05}$ | 283 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.14 | 0.11             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.03             |
| 290                    | 0.09             |
| 300                    | 0.20             |
| 310                    | 0.37             |
| 320                    | 0.58             |
| 330                    | 0.75             |
| 340                    | 0.86             |
| 350                    | 0.934            |
| 360                    | 0.968            |
| 370                    | 0.984            |
| 380                    | 0.992            |
| 390                    | 0.995            |
| 400                    | 0.996            |
| 420                    | 0.995            |
| 440                    | 0.995            |
| 460                    | 0.996            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.997            |
| 800                    | 0.997            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.998            |
| 1 400                  | 0.999            |
| 1 600                  | 0.998            |
| 1 800                  | 0.998            |
| 2 000                  | 0.998            |
| 2 200                  | 0.996            |
| 2 400                  | 0.995            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 487   |
| Yield Point At (°C)                                              | 515   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 125   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 148   |
| Thermal Conductivity $\lambda$ (W/(mK))                          | 0.746 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 104                                            |
| -90 ~ -80                               | 106                                            |
| -80 ~ -70                               | 108                                            |
| -70 ~ -60                               | 110                                            |
| -60 ~ -50                               | 112                                            |
| -50 ~ -40                               | 114                                            |
| -40 ~ -30                               | 116                                            |
| -30 ~ -20                               | 117                                            |
| -20 ~ -10                               | 119                                            |
| -10 ~ 0                                 | 121                                            |
| 0 ~ 10                                  | 122                                            |
| 10 ~ 20                                 | 124                                            |
| 20 ~ 30                                 | 126                                            |
| 30 ~ 40                                 | 127                                            |
| 40 ~ 50                                 | 129                                            |
| 50 ~ 60                                 | 130                                            |
| 60 ~ 70                                 | 132                                            |
| 70 ~ 80                                 | 133                                            |
| 80 ~ 90                                 | 135                                            |
| 90 ~ 100                                | 136                                            |
| 100 ~ 110                               | 137                                            |
| 110 ~ 120                               | 139                                            |
| 120 ~ 130                               | 140                                            |
| 130 ~ 140                               | 141                                            |
| 140 ~ 150                               | 142                                            |
| 150 ~ 160                               | 144                                            |
| 160 ~ 170                               | 145                                            |
| 170 ~ 180                               | 146                                            |
| 180 ~ 190                               | 147                                            |
| 190 ~ 200                               | 148                                            |
| 200 ~ 210                               | 149                                            |
| 210 ~ 220                               | 150                                            |
| 220 ~ 230                               | 151                                            |
| 230 ~ 240                               | 152                                            |
| 240 ~ 250                               | 153                                            |
| 250 ~ 260                               | 154                                            |
| 260 ~ 270                               | 154                                            |
| 270 ~ 280                               | 155                                            |
| 280 ~ 290                               | 156                                            |
| 290 ~ 300                               | 157                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 0.72 |
| Specific Gravity $d$                                     | 3.76 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |      |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | -5.1                                                            | -5.1 | -4.9 | -4.8 | -4.8 | -4.8 | -4.7 | -4.6 | -4.6 | -4.5 | -4.3 | -4.1 |
| -60 ~ -40                                    | -5.5                                                            | -5.4 | -5.3 | -5.2 | -5.2 | -5.1 | -5.1 | -5.0 | -4.9 | -4.8 | -4.7 | -4.3 |
| -40 ~ -20                                    | -5.8                                                            | -5.7 | -5.5 | -5.5 | -5.5 | -5.4 | -5.3 | -5.2 | -5.2 | -5.1 | -4.9 | -4.6 |
| -20 ~ 0                                      | -5.9                                                            | -5.9 | -5.7 | -5.6 | -5.6 | -5.6 | -5.5 | -5.4 | -5.3 | -5.2 | -5.0 | -4.8 |
| 0 ~ 20                                       | -6.0                                                            | -6.0 | -5.9 | -5.8 | -5.8 | -5.7 | -5.7 | -5.5 | -5.5 | -5.2 | -5.1 | -4.8 |
| 20 ~ 40                                      | -6.2                                                            | -6.1 | -6.0 | -5.9 | -5.9 | -5.8 | -5.8 | -5.5 | -5.5 | -5.3 | -5.2 | -4.9 |
| 40 ~ 60                                      | -6.2                                                            | -6.1 | -6.0 | -5.9 | -5.9 | -5.8 | -5.8 | -5.6 | -5.6 | -5.4 | -5.2 | -4.9 |
| 60 ~ 80                                      | -6.3                                                            | -6.2 | -6.1 | -6.0 | -6.0 | -5.9 | -5.8 | -5.7 | -5.6 | -5.4 | -5.2 | -4.8 |
| 80 ~ 100                                     | -6.3                                                            | -6.3 | -6.1 | -6.1 | -6.0 | -6.0 | -5.9 | -5.7 | -5.7 | -5.4 | -5.2 | -4.8 |
| 100 ~ 120                                    | -6.4                                                            | -6.3 | -6.1 | -6.1 | -6.1 | -6.0 | -5.9 | -5.7 | -5.7 | -5.5 | -5.2 | -4.8 |
| 120 ~ 140                                    | -6.4                                                            | -6.4 | -6.1 | -6.1 | -6.1 | -5.9 | -5.9 | -5.6 | -5.6 | -5.4 | -5.2 | -4.8 |
| 140 ~ 160                                    | -6.4                                                            | -6.3 | -6.1 | -6.1 | -6.1 | -6.0 | -5.8 | -5.6 | -5.6 | -5.4 | -5.2 | -4.8 |
| 160 ~ 180                                    | -6.5                                                            | -6.4 | -6.2 | -6.1 | -6.1 | -6.0 | -5.9 | -5.7 | -5.6 | -5.4 | -5.2 | -4.8 |

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## S-FPM 5

Code(d) 552708

Code(e) 554703

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.552 00<br>1.552 000 | Abbe Number $\nu_d$ | 70.70 | Dispersion $n_F - n_C$       | 0.007 808 |
| Refractive Index $n_e$ | 1.553 863             | Abbe Number $\nu_e$ | 70.33 | Dispersion $n_{F'} - n_{C'}$ | 0.007 875 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.530 66 |
| $n_{1970}$         | 1.970 09  | 1.534 41 |
| $n_{1530}$         | 1.529 58  | 1.538 45 |
| $n_{1129}$         | 1.128 64  | 1.542 08 |
| $n_t$              | 1.013 98  | 1.543 30 |
| $n_s$              | 0.852 11  | 1.545 45 |
| $n_{A'}$           | 0.768 19  | 1.546 92 |
| $n_F$              | 0.706 52  | 1.548 28 |
| $n_C$              | 0.656 27  | 1.549 63 |
| $n_{C'}$           | 0.643 85  | 1.550 00 |
| $n_{He-Ne}$        | 0.632 8   | 1.550 36 |
| $n_D$              | 0.589 29  | 1.551 93 |
| $n_d$              | 0.587 56  | 1.552 00 |
| $n_e$              | 0.546 07  | 1.553 86 |
| $n_F$              | 0.486 13  | 1.557 43 |
| $n_{F'}$           | 0.479 99  | 1.557 88 |
| $n_{He-Cd}$        | 0.441 57  | 1.561 11 |
| $n_g$              | 0.435 835 | 1.561 67 |
| $n_h$              | 0.404 656 | 1.565 17 |
| $n_i$              | 0.365 015 | 1.571 11 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 8.398 997 64E-01 |
| $A_2$                           | 5.377 213 12E-01 |
| $A_3$                           | 9.532 477 59E-01 |
| $B_1$                           | 3.764 482 95E-03 |
| $B_2$                           | 1.480 226 22E-02 |
| $B_3$                           | 1.456 755 50E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 2    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 52.1 |
| Phosphate Resistance PR                   | 4.0  |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 76.9  |   |
| Rigidity Modulus G (GPa) | 29.7  |   |
| Poisson's Ratio $\sigma$ | 0.296 |   |
| Knoop Hardness Hk[Class] | 390   | 4 |
| Abrasion Aa              | 413   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.006 321 |
| $n_C - n_{A'}$      | 0.002 702 |
| $n_d - n_C$         | 0.002 375 |
| $n_e - n_C$         | 0.004 238 |
| $n_g - n_d$         | 0.009 666 |
| $n_g - n_F$         | 0.004 233 |
| $n_h - n_g$         | 0.003 502 |
| $n_i - n_g$         | 0.009 440 |
| $n_{C'} - n_t$      | 0.006 699 |
| $n_e - n_{C'}$      | 0.003 860 |
| $n_{F'} - n_e$      | 0.004 015 |
| $n_i - n_{F'}$      | 0.013 228 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.809 6 |
| $\theta_{C,A'}$              | 0.346 1 |
| $\theta_{d,C}$               | 0.304 2 |
| $\theta_{e,C}$               | 0.542 8 |
| $\theta_{g,d}$               | 1.238 0 |
| $\theta_{g,F}$               | 0.542 1 |
| $\theta_{h,g}$               | 0.448 5 |
| $\theta_{i,g}$               | 1.209 0 |
| $\theta'_{C,t}$              | 0.850 7 |
| $\theta'_{e,C'}$             | 0.490 2 |
| $\theta'_{F',e}$             | 0.509 8 |
| $\theta'_{i,F'}$             | 1.679 7 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.068 8 |
| $\Delta\theta_{C,A'}$ | -0.015 5 |
| $\Delta\theta_{g,d}$  | 0.020 1  |
| $\Delta\theta_{g,F}$  | 0.015 0  |
| $\Delta\theta_{i,g}$  | 0.076 0  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 345  | $\lambda_5$      |     |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 335  | $\lambda_{0.05}$ | 282 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.14 | 0.12             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.04             |
| 290                    | 0.10             |
| 300                    | 0.20             |
| 310                    | 0.35             |
| 320                    | 0.56             |
| 330                    | 0.73             |
| 340                    | 0.86             |
| 350                    | 0.929            |
| 360                    | 0.967            |
| 370                    | 0.984            |
| 380                    | 0.992            |
| 390                    | 0.995            |
| 400                    | 0.996            |
| 420                    | 0.995            |
| 440                    | 0.995            |
| 460                    | 0.996            |
| 480                    | 0.998            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.999            |
| 1 600                  | 0.998            |
| 1 800                  | 0.998            |
| 2 000                  | 0.997            |
| 2 200                  | 0.994            |
| 2 400                  | 0.993            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 474   |
| Yield Point At (°C)                                              | 501   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 111   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 132   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.765 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 91                                             |
| -90 ~ -80                               | 93                                             |
| -80 ~ -70                               | 94                                             |
| -70 ~ -60                               | 96                                             |
| -60 ~ -50                               | 98                                             |
| -50 ~ -40                               | 100                                            |
| -40 ~ -30                               | 102                                            |
| -30 ~ -20                               | 103                                            |
| -20 ~ -10                               | 105                                            |
| -10 ~ 0                                 | 107                                            |
| 0 ~ 10                                  | 108                                            |
| 10 ~ 20                                 | 110                                            |
| 20 ~ 30                                 | 111                                            |
| 30 ~ 40                                 | 113                                            |
| 40 ~ 50                                 | 114                                            |
| 50 ~ 60                                 | 116                                            |
| 60 ~ 70                                 | 117                                            |
| 70 ~ 80                                 | 118                                            |
| 80 ~ 90                                 | 120                                            |
| 90 ~ 100                                | 121                                            |
| 100 ~ 110                               | 122                                            |
| 110 ~ 120                               | 124                                            |
| 120 ~ 130                               | 125                                            |
| 130 ~ 140                               | 126                                            |
| 140 ~ 150                               | 127                                            |
| 150 ~ 160                               | 128                                            |
| 160 ~ 170                               | 129                                            |
| 170 ~ 180                               | 130                                            |
| 180 ~ 190                               | 131                                            |
| 190 ~ 200                               | 132                                            |
| 200 ~ 210                               | 133                                            |
| 210 ~ 220                               | 134                                            |
| 220 ~ 230                               | 135                                            |
| 230 ~ 240                               | 136                                            |
| 240 ~ 250                               | 136                                            |
| 250 ~ 260                               | 137                                            |
| 260 ~ 270                               | 138                                            |
| 270 ~ 280                               | 139                                            |
| 280 ~ 290                               | 139                                            |
| 290 ~ 300                               | 140                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.29 |
| Specific Gravity $d$                                      | 3.74 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |      |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | -2.6                                                            | -2.6 | -2.5 | -2.4 | -2.4 | -2.3 | -2.3 | -2.0 | -2.0 | -1.8 | -1.6 | -1.2 |
| -60 ~ -40                                    | -3.0                                                            | -2.8 | -2.7 | -2.6 | -2.6 | -2.6 | -2.5 | -2.3 | -2.3 | -2.0 | -1.8 | -1.4 |
| -40 ~ -20                                    | -3.0                                                            | -3.0 | -2.9 | -2.8 | -2.8 | -2.7 | -2.6 | -2.4 | -2.4 | -2.2 | -1.9 | -1.5 |
| -20 ~ 0                                      | -3.2                                                            | -3.1 | -3.0 | -2.9 | -2.9 | -2.8 | -2.7 | -2.5 | -2.5 | -2.3 | -2.1 | -1.5 |
| 0 ~ 20                                       | -3.3                                                            | -3.2 | -3.1 | -2.9 | -3.0 | -2.8 | -2.7 | -2.5 | -2.5 | -2.3 | -2.0 | -1.6 |
| 20 ~ 40                                      | -3.3                                                            | -3.3 | -3.1 | -3.0 | -2.9 | -2.8 | -2.8 | -2.6 | -2.5 | -2.3 | -2.0 | -1.6 |
| 40 ~ 60                                      | -3.3                                                            | -3.2 | -3.1 | -3.0 | -3.0 | -2.9 | -2.8 | -2.6 | -2.6 | -2.3 | -2.1 | -1.5 |
| 60 ~ 80                                      | -3.4                                                            | -3.3 | -3.1 | -3.0 | -3.1 | -2.9 | -2.8 | -2.6 | -2.5 | -2.3 | -2.0 | -1.5 |
| 80 ~ 100                                     | -3.4                                                            | -3.3 | -3.2 | -3.1 | -3.1 | -3.0 | -2.8 | -2.6 | -2.5 | -2.3 | -2.0 | -1.4 |
| 100 ~ 120                                    | -3.5                                                            | -3.4 | -3.2 | -3.1 | -3.1 | -3.0 | -2.8 | -2.6 | -2.5 | -2.3 | -2.0 | -1.4 |
| 120 ~ 140                                    | -3.5                                                            | -3.3 | -3.1 | -3.1 | -3.0 | -2.9 | -2.8 | -2.6 | -2.6 | -2.3 | -2.0 | -1.4 |
| 140 ~ 160                                    | -3.5                                                            | -3.4 | -3.2 | -3.2 | -3.1 | -3.0 | -2.9 | -2.7 | -2.6 | -2.3 | -2.0 | -1.4 |
| 160 ~ 180                                    | -3.6                                                            | -3.5 | -3.3 | -3.3 | -3.2 | -3.1 | -3.0 | -2.8 | -2.7 | -2.4 | -2.1 | -1.4 |

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## S-FSL 5

Code(d) 487702

Code(e) 489701

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.487 49<br>1.487 490 | Abbe Number $\nu_d$ | 70.23 | Dispersion $n_F - n_C$       | 0.006 941 |
| Refractive Index $n_e$ | 1.489 147             | Abbe Number $\nu_e$ | 70.04 | Dispersion $n_{F'} - n_{C'}$ | 0.006 984 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.462 27 |
| $n_{1970}$         | 1.970 09  | 1.467 65 |
| $n_{1530}$         | 1.529 58  | 1.473 24 |
| $n_{1129}$         | 1.128 64  | 1.477 78 |
| $n_t$              | 1.013 98  | 1.479 15 |
| $n_s$              | 0.852 11  | 1.481 38 |
| $n_{A'}$           | 0.768 19  | 1.482 82 |
| $n_F$              | 0.706 52  | 1.484 10 |
| $n_C$              | 0.656 27  | 1.485 34 |
| $n_{C'}$           | 0.643 85  | 1.485 69 |
| $n_{He-Ne}$        | 0.632 8   | 1.486 01 |
| $n_D$              | 0.589 29  | 1.487 43 |
| $n_d$              | 0.587 56  | 1.487 49 |
| $n_e$              | 0.546 07  | 1.489 15 |
| $n_F$              | 0.486 13  | 1.492 28 |
| $n_{F'}$           | 0.479 99  | 1.492 67 |
| $n_{He-Cd}$        | 0.441 57  | 1.495 48 |
| $n_g$              | 0.435 835 | 1.495 96 |
| $n_h$              | 0.404 656 | 1.498 98 |
| $n_i$              | 0.365 015 | 1.504 06 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 1.174 470 43E+00  |
| $A_2$                           | 1.400 561 54E-02  |
| $A_3$                           | 1.192 724 35E+00  |
| $B_1$                           | 8.418 551 81E-03  |
| $B_2$                           | -5.817 907 67E-02 |
| $B_3$                           | 1.295 997 26E+02  |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 3   |
| Acid Resistance(Powder) Group RA(P)       | 4   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 3.0 |
| Phosphate Resistance PR                   | 2.0 |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 62.3    |
| Rigidity Modulus G (GPa) | 25.4    |
| Poisson's Ratio $\sigma$ | 0.227   |
| Knoop Hardness Hk[Class] | 520   5 |
| Abrasion Aa              | 117     |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.006 194 |
| $n_C - n_{A'}$      | 0.002 522 |
| $n_d - n_C$         | 0.002 146 |
| $n_e - n_C$         | 0.003 803 |
| $n_g - n_d$         | 0.008 474 |
| $n_g - n_F$         | 0.003 679 |
| $n_h - n_g$         | 0.003 019 |
| $n_i - n_g$         | 0.008 099 |
| $n_{C'} - n_t$      | 0.006 539 |
| $n_e - n_{C'}$      | 0.003 458 |
| $n_{F'} - n_e$      | 0.003 526 |
| $n_i - n_{F'}$      | 0.011 390 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.892 4 |
| $\theta_{C,A'}$              | 0.363 3 |
| $\theta_{d,C}$               | 0.309 2 |
| $\theta_{e,C}$               | 0.547 9 |
| $\theta_{g,d}$               | 1.220 9 |
| $\theta_{g,F}$               | 0.530 0 |
| $\theta_{h,g}$               | 0.435 0 |
| $\theta_{i,g}$               | 1.166 8 |
| $\theta'_{C,t}$              | 0.936 3 |
| $\theta'_{e,C'}$             | 0.495 1 |
| $\theta'_{F,e}$              | 0.504 9 |
| $\theta'_{i,F'}$             | 1.630 9 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.016 2 |
| $\Delta\theta_{C,A'}$ | 0.002 3 |
| $\Delta\theta_{g,d}$  | 0.002 0 |
| $\Delta\theta_{g,F}$  | 0.002 2 |
| $\Delta\theta_{i,g}$  | 0.029 9 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 300  | $\lambda_5$      | 265 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 304  | $\lambda_{0.05}$ | 277 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.00 | 0.00             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.13             |
| 290                    | 0.43             |
| 300                    | 0.73             |
| 310                    | 0.89             |
| 320                    | 0.961            |
| 330                    | 0.984            |
| 340                    | 0.992            |
| 350                    | 0.995            |
| 360                    | 0.995            |
| 370                    | 0.998            |
| 380                    | 0.998            |
| 390                    | 0.999            |
| 400                    | 0.999            |
| 420                    | 0.999            |
| 440                    | 0.999            |
| 460                    | 0.999            |
| 480                    | 0.999            |
| 500                    | 0.999            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.982            |
| 1 600                  | 0.992            |
| 1 800                  | 0.985            |
| 2 000                  | 0.971            |
| 2 200                  | 0.88             |
| 2 400                  | 0.87             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 457  |
| Annealing Point AP (°C)                                          | 491  |
| Transformation Temperature Tg (°C)                               | 497  |
| Yield Point At (°C)                                              | 592  |
| Softening Point SP (°C)                                          | 679  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 90   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 98   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.01 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 81                                             |
| -90 ~ -80                               | 82                                             |
| -80 ~ -70                               | 82                                             |
| -70 ~ -60                               | 83                                             |
| -60 ~ -50                               | 84                                             |
| -50 ~ -40                               | 85                                             |
| -40 ~ -30                               | 86                                             |
| -30 ~ -20                               | 87                                             |
| -20 ~ -10                               | 87                                             |
| -10 ~ 0                                 | 88                                             |
| 0 ~ 10                                  | 89                                             |
| 10 ~ 20                                 | 90                                             |
| 20 ~ 30                                 | 90                                             |
| 30 ~ 40                                 | 91                                             |
| 40 ~ 50                                 | 92                                             |
| 50 ~ 60                                 | 92                                             |
| 60 ~ 70                                 | 93                                             |
| 70 ~ 80                                 | 93                                             |
| 80 ~ 90                                 | 94                                             |
| 90 ~ 100                                | 94                                             |
| 100 ~ 110                               | 95                                             |
| 110 ~ 120                               | 95                                             |
| 120 ~ 130                               | 96                                             |
| 130 ~ 140                               | 96                                             |
| 140 ~ 150                               | 96                                             |
| 150 ~ 160                               | 97                                             |
| 160 ~ 170                               | 97                                             |
| 170 ~ 180                               | 97                                             |
| 180 ~ 190                               | 98                                             |
| 190 ~ 200                               | 98                                             |
| 200 ~ 210                               | 98                                             |
| 210 ~ 220                               | 98                                             |
| 220 ~ 230                               | 98                                             |
| 230 ~ 240                               | 99                                             |
| 240 ~ 250                               | 99                                             |
| 250 ~ 260                               | 99                                             |
| 260 ~ 270                               | 99                                             |
| 270 ~ 280                               | 99                                             |
| 280 ~ 290                               | 99                                             |
| 290 ~ 300                               | 99                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.87 |
| Specific Gravity $d$                                     | 2.46 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |      |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | -2.2                                                            | -2.1 | -2.0 | -1.9 | -1.9 | -1.8 | -1.8 | -1.6 | -1.6 | -1.4 | -1.2 | -0.9 |
| -60 ~ -40                                    | -2.2                                                            | -2.1 | -2.0 | -1.9 | -1.9 | -1.8 | -1.8 | -1.6 | -1.6 | -1.5 | -1.2 | -0.9 |
| -40 ~ -20                                    | -2.0                                                            | -2.0 | -1.9 | -1.9 | -1.8 | -1.8 | -1.7 | -1.6 | -1.6 | -1.3 | -1.1 | -0.8 |
| -20 ~ 0                                      | -1.9                                                            | -1.9 | -1.8 | -1.7 | -1.7 | -1.6 | -1.6 | -1.4 | -1.4 | -1.1 | -1.0 | -0.6 |
| 0 ~ 20                                       | -1.7                                                            | -1.7 | -1.5 | -1.5 | -1.5 | -1.4 | -1.4 | -1.2 | -1.2 | -1.0 | -0.9 | -0.5 |
| 20 ~ 40                                      | -1.5                                                            | -1.5 | -1.4 | -1.3 | -1.3 | -1.2 | -1.2 | -1.0 | -1.0 | -0.9 | -0.7 | -0.3 |
| 40 ~ 60                                      | -1.4                                                            | -1.3 | -1.2 | -1.2 | -1.2 | -1.0 | -1.0 | -0.8 | -0.8 | -0.6 | -0.4 | -0.1 |
| 60 ~ 80                                      | -1.2                                                            | -1.1 | -1.0 | -1.0 | -0.9 | -0.9 | -0.8 | -0.7 | -0.7 | -0.5 | -0.3 | 0.1  |
| 80 ~ 100                                     | -1.0                                                            | -0.9 | -0.8 | -0.8 | -0.7 | -0.7 | -0.6 | -0.5 | -0.5 | -0.3 | -0.1 | 0.2  |
| 100 ~ 120                                    | -0.8                                                            | -0.8 | -0.6 | -0.6 | -0.6 | -0.5 | -0.5 | -0.3 | -0.3 | -0.1 | 0.0  | 0.3  |
| 120 ~ 140                                    | -0.7                                                            | -0.6 | -0.5 | -0.5 | -0.5 | -0.4 | -0.3 | -0.2 | -0.2 | 0.0  | 0.1  | 0.6  |
| 140 ~ 160                                    | -0.6                                                            | -0.4 | -0.3 | -0.3 | -0.3 | -0.2 | -0.1 | 0.0  | 0.0  | 0.2  | 0.3  | 0.6  |
| 160 ~ 180                                    | -0.4                                                            | -0.4 | -0.2 | -0.2 | -0.2 | -0.1 | -0.1 | 0.1  | 0.1  | 0.2  | 0.4  | 0.7  |

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## S-FTM16

Code(d) 593353

Code(e) 597350

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.592 70<br>1.592 701 | Abbe Number $\nu_d$ | 35.31 | Dispersion $n_F - n_C$       | 0.016 785 |
| Refractive Index $n_e$ | 1.596 670             | Abbe Number $\nu_e$ | 35.03 | Dispersion $n_{F'} - n_{C'}$ | 0.017 031 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.556 03 |
| $n_{1970}$         | 1.970 09  | 1.561 54 |
| $n_{1530}$         | 1.529 58  | 1.567 67 |
| $n_{1129}$         | 1.128 64  | 1.573 57 |
| $n_t$              | 1.013 98  | 1.575 69 |
| $n_s$              | 0.852 11  | 1.579 62 |
| $n_{A'}$           | 0.768 19  | 1.582 43 |
| $n_F$              | 0.706 52  | 1.585 08 |
| $n_C$              | 0.656 27  | 1.587 79 |
| $n_{C'}$           | 0.643 85  | 1.588 56 |
| $n_{He-Ne}$        | 0.632 8   | 1.589 29 |
| $n_D$              | 0.589 29  | 1.592 55 |
| $n_d$              | 0.587 56  | 1.592 70 |
| $n_e$              | 0.546 07  | 1.596 67 |
| $n_F$              | 0.486 13  | 1.604 58 |
| $n_{F'}$           | 0.479 99  | 1.605 59 |
| $n_{He-Cd}$        | 0.441 57  | 1.613 18 |
| $n_g$              | 0.435 835 | 1.614 54 |
| $n_h$              | 0.404 656 | 1.623 34 |
| $n_i$              | 0.365 015 | 1.639 74 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.329 409 07E+00 |
| $A_2$                           | 1.415 121 25E-01 |
| $A_3$                           | 1.442 990 68E+00 |
| $B_1$                           | 1.023 772 87E-02 |
| $B_2$                           | 5.780 819 56E-02 |
| $B_3$                           | 1.505 971 39E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 2.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 65.3  |
| Rigidity Modulus G (GPa) | 26.4  |
| Poisson's Ratio $\sigma$ | 0.238 |
| Knoop Hardness Hk[Class] | 450 5 |
| Abrasion Aa              | 181   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.012 104 |
| $n_C - n_{A'}$      | 0.005 365 |
| $n_d - n_C$         | 0.004 906 |
| $n_e - n_C$         | 0.008 875 |
| $n_g - n_d$         | 0.021 838 |
| $n_g - n_F$         | 0.009 959 |
| $n_h - n_g$         | 0.008 800 |
| $n_i - n_g$         | 0.025 202 |
| $n_{C'} - n_t$      | 0.012 872 |
| $n_e - n_{C'}$      | 0.008 107 |
| $n_{F'} - n_e$      | 0.008 924 |
| $n_i - n_{F'}$      | 0.034 147 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.721 1 |
| $\theta_{C,A'}$              | 0.319 6 |
| $\theta_{d,C}$               | 0.292 3 |
| $\theta_{e,C}$               | 0.528 7 |
| $\theta_{g,d}$               | 1.301 0 |
| $\theta_{g,F}$               | 0.593 3 |
| $\theta_{h,g}$               | 0.524 3 |
| $\theta_{i,g}$               | 1.501 5 |
| $\theta'_{C,t}$              | 0.755 8 |
| $\theta'_{e,C'}$             | 0.476 0 |
| $\theta'_{F',e}$             | 0.524 0 |
| $\theta'_{i,F'}$             | 2.005 0 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.008 8 |
| $\Delta\theta_{C,A'}$ | 0.001 0 |
| $\Delta\theta_{g,d}$  | 0.009 6 |
| $\Delta\theta_{g,F}$  | 0.009 0 |
| $\Delta\theta_{i,g}$  | 0.072 1 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 380  | $\lambda_5$      | 350 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 370  | $\lambda_{0.05}$ | 350 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.43 | 0.42             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.04             |
| 360                    | 0.43             |
| 370                    | 0.81             |
| 380                    | 0.934            |
| 390                    | 0.973            |
| 400                    | 0.984            |
| 420                    | 0.989            |
| 440                    | 0.990            |
| 460                    | 0.991            |
| 480                    | 0.992            |
| 500                    | 0.994            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.996            |
| 700                    | 0.996            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.996            |
| 1 600                  | 0.994            |
| 1 800                  | 0.989            |
| 2 000                  | 0.987            |
| 2 200                  | 0.959            |
| 2 400                  | 0.953            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 502   |
| Yield Point At (°C)                                              | 559   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 90    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 102   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.947 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 79                                             |
| -90 ~ -80                               | 80                                             |
| -80 ~ -70                               | 81                                             |
| -70 ~ -60                               | 82                                             |
| -60 ~ -50                               | 83                                             |
| -50 ~ -40                               | 84                                             |
| -40 ~ -30                               | 85                                             |
| -30 ~ -20                               | 86                                             |
| -20 ~ -10                               | 86                                             |
| -10 ~ 0                                 | 87                                             |
| 0 ~ 10                                  | 88                                             |
| 10 ~ 20                                 | 89                                             |
| 20 ~ 30                                 | 90                                             |
| 30 ~ 40                                 | 91                                             |
| 40 ~ 50                                 | 91                                             |
| 50 ~ 60                                 | 92                                             |
| 60 ~ 70                                 | 93                                             |
| 70 ~ 80                                 | 94                                             |
| 80 ~ 90                                 | 94                                             |
| 90 ~ 100                                | 95                                             |
| 100 ~ 110                               | 96                                             |
| 110 ~ 120                               | 97                                             |
| 120 ~ 130                               | 97                                             |
| 130 ~ 140                               | 98                                             |
| 140 ~ 150                               | 99                                             |
| 150 ~ 160                               | 99                                             |
| 160 ~ 170                               | 100                                            |
| 170 ~ 180                               | 100                                            |
| 180 ~ 190                               | 101                                            |
| 190 ~ 200                               | 102                                            |
| 200 ~ 210                               | 102                                            |
| 210 ~ 220                               | 103                                            |
| 220 ~ 230                               | 103                                            |
| 230 ~ 240                               | 104                                            |
| 240 ~ 250                               | 104                                            |
| 250 ~ 260                               | 105                                            |
| 260 ~ 270                               | 105                                            |
| 270 ~ 280                               | 106                                            |
| 280 ~ 290                               | 106                                            |
| 290 ~ 300                               | 106                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 3.33 |
| Specific Gravity $d$                                      | 2.64 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |     |     |     |     |     |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | -1.5                                                            | -1.3 | -0.9 | -0.8 | -0.8 | -0.6 | -0.4 | 0.1 | 0.3 | 0.9 | 1.7 | 3.7 |
| -60 ~ -40                                    | -1.5                                                            | -1.4 | -1.0 | -0.8 | -0.8 | -0.6 | -0.4 | 0.1 | 0.2 | 0.9 | 1.8 | 3.8 |
| -40 ~ -20                                    | -1.5                                                            | -1.4 | -1.0 | -0.9 | -0.7 | -0.5 | -0.3 | 0.3 | 0.3 | 1.1 | 1.9 | 4.1 |
| -20 ~ 0                                      | -1.5                                                            | -1.3 | -0.9 | -0.8 | -0.7 | -0.5 | -0.1 | 0.4 | 0.5 | 1.3 | 2.2 | 4.5 |
| 0 ~ 20                                       | -1.4                                                            | -1.1 | -0.7 | -0.6 | -0.5 | -0.3 | 0.0  | 0.6 | 0.7 | 1.5 | 2.5 | 4.8 |
| 20 ~ 40                                      | -1.2                                                            | -1.0 | -0.6 | -0.4 | -0.4 | -0.1 | 0.1  | 0.8 | 0.9 | 1.7 | 2.7 | 5.2 |
| 40 ~ 60                                      | -1.1                                                            | -0.9 | -0.5 | -0.3 | -0.3 | 0.0  | 0.3  | 1.0 | 1.0 | 2.0 | 3.1 | 5.6 |
| 60 ~ 80                                      | -1.0                                                            | -0.8 | -0.3 | -0.1 | -0.1 | 0.2  | 0.5  | 1.2 | 1.3 | 2.2 | 3.3 | 5.9 |
| 80 ~ 100                                     | -1.0                                                            | -0.8 | -0.2 | 0.0  | 0.1  | 0.4  | 0.7  | 1.4 | 1.5 | 2.5 | 3.6 | 6.3 |
| 100 ~ 120                                    | -0.9                                                            | -0.6 | 0.0  | 0.1  | 0.2  | 0.5  | 0.8  | 1.6 | 1.7 | 2.7 | 3.9 | 6.7 |
| 120 ~ 140                                    | -0.8                                                            | -0.5 | 0.0  | 0.2  | 0.3  | 0.6  | 0.9  | 1.7 | 1.8 | 2.9 | 4.1 | 7.0 |
| 140 ~ 160                                    | -0.7                                                            | -0.5 | 0.1  | 0.3  | 0.3  | 0.7  | 1.0  | 1.8 | 1.9 | 3.0 | 4.3 | 7.4 |
| 160 ~ 180                                    | -0.8                                                            | -0.5 | 0.1  | 0.4  | 0.5  | 0.8  | 1.2  | 2.0 | 2.1 | 3.2 | 4.5 | 7.7 |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.785 90<br>1.785 896 | Abbe Number $\nu_d$ | 44.20 | Dispersion $n_F - n_C$       | 0.017 780 |
| Refractive Index $n_e$ | 1.790 123             | Abbe Number $\nu_e$ | 43.95 | Dispersion $n_{F'} - n_{C'}$ | 0.017 979 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.742 65 |
| $n_{1970}$         | 1.970 09  | 1.749 72 |
| $n_{1530}$         | 1.529 58  | 1.757 40 |
| $n_{1129}$         | 1.128 64  | 1.764 52 |
| $n_t$              | 1.013 98  | 1.767 00 |
| $n_s$              | 0.852 11  | 1.771 50 |
| $n_{A'}$           | 0.768 19  | 1.774 66 |
| $n_F$              | 0.706 52  | 1.777 61 |
| $n_C$              | 0.656 27  | 1.780 58 |
| $n_{C'}$           | 0.643 85  | 1.781 42 |
| $n_{He-Ne}$        | 0.632 8   | 1.782 21 |
| $n_D$              | 0.589 29  | 1.785 74 |
| $n_d$              | 0.587 56  | 1.785 90 |
| $n_e$              | 0.546 07  | 1.790 12 |
| $n_F$              | 0.486 13  | 1.798 36 |
| $n_{F'}$           | 0.479 99  | 1.799 40 |
| $n_{He-Cd}$        | 0.441 57  | 1.807 04 |
| $n_g$              | 0.435 835 | 1.808 38 |
| $n_h$              | 0.404 656 | 1.816 87 |
| $n_i$              | 0.365 015 | 1.831 75 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.825 869 91E+00 |
| $A_2$                           | 2.830 233 49E-01 |
| $A_3$                           | 1.359 643 19E+00 |
| $B_1$                           | 9.352 971 52E-03 |
| $B_2$                           | 3.738 030 57E-02 |
| $B_3$                           | 1.006 557 98E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 4   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 2.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 112.9 |
| Rigidity Modulus G (GPa) | 43.5  |
| Poisson's Ratio $\sigma$ | 0.297 |
| Knoop Hardness Hk[Class] | 650 7 |
| Abrasion Aa              | 80    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.013 580 |
| $n_C - n_{A'}$      | 0.005 923 |
| $n_d - n_C$         | 0.005 312 |
| $n_e - n_C$         | 0.009 539 |
| $n_g - n_d$         | 0.022 480 |
| $n_g - n_F$         | 0.010 012 |
| $n_h - n_g$         | 0.008 492 |
| $n_i - n_g$         | 0.023 375 |
| $n_{C'} - n_t$      | 0.014 419 |
| $n_e - n_{C'}$      | 0.008 700 |
| $n_{F'} - n_e$      | 0.009 279 |
| $n_i - n_{F'}$      | 0.032 349 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.763 8 |
| $\theta_{C,A'}$              | 0.333 1 |
| $\theta_{d,C}$               | 0.298 8 |
| $\theta_{e,C}$               | 0.536 5 |
| $\theta_{g,d}$               | 1.264 3 |
| $\theta_{g,F}$               | 0.563 1 |
| $\theta_{h,g}$               | 0.477 6 |
| $\theta_{i,g}$               | 1.314 7 |
| $\theta'_{C,t}$              | 0.802 0 |
| $\theta'_{e,C'}$             | 0.483 9 |
| $\theta'_{F',e}$             | 0.516 1 |
| $\theta'_{i,F'}$             | 1.799 3 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.009 7  |
| $\Delta\theta_{C,A'}$ | 0.003 7  |
| $\Delta\theta_{g,d}$  | -0.008 6 |
| $\Delta\theta_{g,F}$  | -0.006 9 |
| $\Delta\theta_{i,g}$  | -0.040 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 390  | $\lambda_5$      | 335 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 366  | $\lambda_{0.05}$ | 333 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.83 | 0.82             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.01             |
| 340                    | 0.17             |
| 350                    | 0.51             |
| 360                    | 0.73             |
| 370                    | 0.84             |
| 380                    | 0.910            |
| 390                    | 0.942            |
| 400                    | 0.961            |
| 420                    | 0.977            |
| 440                    | 0.984            |
| 460                    | 0.989            |
| 480                    | 0.993            |
| 500                    | 0.995            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.997            |
| 1 000                  | 0.996            |
| 1 200                  | 0.996            |
| 1 400                  | 0.991            |
| 1 600                  | 0.989            |
| 1 800                  | 0.981            |
| 2 000                  | 0.957            |
| 2 200                  | 0.89             |
| 2 400                  | 0.68             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 568   |
| Annealing Point AP (°C)                                          | 598   |
| Transformation Temperature Tg (°C)                               | 614   |
| Yield Point At (°C)                                              | 649   |
| Softening Point SP (°C)                                          | 677   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 59    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 73    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.826 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 47                                             |
| -90 ~ -80                               | 48                                             |
| -80 ~ -70                               | 49                                             |
| -70 ~ -60                               | 50                                             |
| -60 ~ -50                               | 51                                             |
| -50 ~ -40                               | 53                                             |
| -40 ~ -30                               | 54                                             |
| -30 ~ -20                               | 55                                             |
| -20 ~ -10                               | 56                                             |
| -10 ~ 0                                 | 57                                             |
| 0 ~ 10                                  | 58                                             |
| 10 ~ 20                                 | 59                                             |
| 20 ~ 30                                 | 60                                             |
| 30 ~ 40                                 | 61                                             |
| 40 ~ 50                                 | 62                                             |
| 50 ~ 60                                 | 63                                             |
| 60 ~ 70                                 | 64                                             |
| 70 ~ 80                                 | 65                                             |
| 80 ~ 90                                 | 65                                             |
| 90 ~ 100                                | 66                                             |
| 100 ~ 110                               | 67                                             |
| 110 ~ 120                               | 68                                             |
| 120 ~ 130                               | 69                                             |
| 130 ~ 140                               | 69                                             |
| 140 ~ 150                               | 70                                             |
| 150 ~ 160                               | 71                                             |
| 160 ~ 170                               | 72                                             |
| 170 ~ 180                               | 72                                             |
| 180 ~ 190                               | 73                                             |
| 190 ~ 200                               | 73                                             |
| 200 ~ 210                               | 74                                             |
| 210 ~ 220                               | 75                                             |
| 220 ~ 230                               | 75                                             |
| 230 ~ 240                               | 76                                             |
| 240 ~ 250                               | 76                                             |
| 250 ~ 260                               | 77                                             |
| 260 ~ 270                               | 77                                             |
| 270 ~ 280                               | 78                                             |
| 280 ~ 290                               | 78                                             |
| 290 ~ 300                               | 78                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.88 |
| Specific Gravity $d$                                     | 4.40 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 3.7                                                             | 3.9 | 4.4 | 4.5 | 4.7 | 4.9 | 5.1 | 5.6 | 5.7 | 6.4 | 6.9 | 8.2 |
| -60 ~ -40                                    | 3.7                                                             | 4.0 | 4.4 | 4.7 | 4.7 | 4.9 | 5.2 | 5.7 | 5.7 | 6.4 | 7.0 | 8.2 |
| -40 ~ -20                                    | 3.8                                                             | 4.1 | 4.6 | 4.7 | 4.8 | 5.0 | 5.3 | 5.9 | 5.9 | 6.6 | 7.2 | 8.5 |
| -20 ~ 0                                      | 4.0                                                             | 4.2 | 4.8 | 4.9 | 5.0 | 5.3 | 5.5 | 6.0 | 6.1 | 6.7 | 7.3 | 8.7 |
| 0 ~ 20                                       | 4.1                                                             | 4.4 | 4.9 | 5.1 | 5.1 | 5.4 | 5.7 | 6.2 | 6.3 | 6.9 | 7.6 | 8.9 |
| 20 ~ 40                                      | 4.3                                                             | 4.5 | 5.0 | 5.2 | 5.3 | 5.6 | 5.9 | 6.4 | 6.5 | 7.1 | 7.8 | 9.1 |
| 40 ~ 60                                      | 4.4                                                             | 4.7 | 5.3 | 5.5 | 5.5 | 5.8 | 6.0 | 6.6 | 6.7 | 7.3 | 8.0 | 9.3 |
| 60 ~ 80                                      | 4.6                                                             | 4.8 | 5.4 | 5.5 | 5.6 | 5.9 | 6.1 | 6.7 | 6.8 | 7.5 | 8.2 | 9.5 |
| 80 ~ 100                                     | 4.7                                                             | 4.9 | 5.5 | 5.6 | 5.7 | 6.0 | 6.3 | 6.8 | 6.9 | 7.6 | 8.3 | 9.6 |
| 100 ~ 120                                    | 4.6                                                             | 5.0 | 5.5 | 5.7 | 5.8 | 6.1 | 6.3 | 6.9 | 7.0 | 7.7 | 8.4 | 9.8 |
| 120 ~ 140                                    | 4.7                                                             | 5.0 | 5.6 | 5.7 | 5.8 | 6.1 | 6.4 | 7.0 | 7.0 | 7.7 | 8.5 | 9.8 |
| 140 ~ 160                                    | 4.6                                                             | 4.9 | 5.5 | 5.7 | 5.7 | 6.0 | 6.3 | 6.9 | 7.0 | 7.7 | 8.4 | 9.9 |
| 160 ~ 180                                    | 4.5                                                             | 4.8 | 5.4 | 5.6 | 5.6 | 5.9 | 6.2 | 6.8 | 6.9 | 7.7 | 8.5 | 9.9 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.799 52<br>1.799 516 | Abbe Number $\nu_d$ | 42.22 | Dispersion $n_F - n_C$       | 0.018 935 |
| Refractive Index $n_e$ | 1.804 015             | Abbe Number $\nu_e$ | 41.97 | Dispersion $n_{F'} - n_{C'}$ | 0.019 157 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.754 95 |
| $n_{1970}$         | 1.970 09  | 1.762 02 |
| $n_{1530}$         | 1.529 58  | 1.769 76 |
| $n_{1129}$         | 1.128 64  | 1.777 03 |
| $n_t$              | 1.013 98  | 1.779 61 |
| $n_s$              | 0.852 11  | 1.784 30 |
| $n_{A'}$           | 0.768 19  | 1.787 62 |
| $n_F$              | 0.706 52  | 1.790 73 |
| $n_C$              | 0.656 27  | 1.793 88 |
| $n_{C'}$           | 0.643 85  | 1.794 77 |
| $n_{He-Ne}$        | 0.632 8   | 1.795 60 |
| $n_D$              | 0.589 29  | 1.799 35 |
| $n_d$              | 0.587 56  | 1.799 52 |
| $n_e$              | 0.546 07  | 1.804 01 |
| $n_F$              | 0.486 13  | 1.812 81 |
| $n_{F'}$           | 0.479 99  | 1.813 93 |
| $n_{He-Cd}$        | 0.441 57  | 1.822 11 |
| $n_g$              | 0.435 835 | 1.823 55 |
| $n_h$              | 0.404 656 | 1.832 71 |
| $n_i$              | 0.365 015 | 1.848 85 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.853 909 25E+00 |
| $A_2$                           | 2.979 255 55E-01 |
| $A_3$                           | 1.393 820 86E+00 |
| $B_1$                           | 9.553 206 87E-03 |
| $B_2$                           | 3.938 168 50E-02 |
| $B_3$                           | 1.027 068 48E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 111.9 |
| Rigidity Modulus G (GPa) | 43.1  |
| Poisson's Ratio $\sigma$ | 0.297 |
| Knoop Hardness Hk[Class] | 650 7 |
| Abrasion Aa              | 85    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.014 274 |
| $n_C - n_{A'}$      | 0.006 258 |
| $n_d - n_C$         | 0.005 637 |
| $n_e - n_C$         | 0.010 136 |
| $n_g - n_d$         | 0.024 038 |
| $n_g - n_F$         | 0.010 740 |
| $n_h - n_g$         | 0.009 152 |
| $n_i - n_g$         | 0.025 292 |
| $n_{C'} - n_t$      | 0.015 163 |
| $n_e - n_{C'}$      | 0.009 247 |
| $n_{F'} - n_e$      | 0.009 910 |
| $n_i - n_{F'}$      | 0.034 921 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.753 8 |
| $\theta_{C,A'}$              | 0.330 5 |
| $\theta_{d,C}$               | 0.297 7 |
| $\theta_{e,C}$               | 0.535 3 |
| $\theta_{g,d}$               | 1.269 5 |
| $\theta_{g,F}$               | 0.567 2 |
| $\theta_{h,g}$               | 0.483 3 |
| $\theta_{i,g}$               | 1.335 7 |
| $\theta'_{C,t}$              | 0.791 5 |
| $\theta'_{e,C'}$             | 0.482 7 |
| $\theta'_{F,e}$              | 0.517 3 |
| $\theta'_{i,F'}$             | 1.822 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.009 0  |
| $\Delta\theta_{C,A'}$ | 0.003 5  |
| $\Delta\theta_{g,d}$  | -0.007 5 |
| $\Delta\theta_{g,F}$  | -0.006 0 |
| $\Delta\theta_{i,g}$  | -0.035 8 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 395  | $\lambda_5$      | 330 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 367  | $\lambda_{0.05}$ | 331 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.03 | 1.10             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.02             |
| 340                    | 0.23             |
| 350                    | 0.52             |
| 360                    | 0.72             |
| 370                    | 0.83             |
| 380                    | 0.89             |
| 390                    | 0.931            |
| 400                    | 0.951            |
| 420                    | 0.971            |
| 440                    | 0.979            |
| 460                    | 0.985            |
| 480                    | 0.990            |
| 500                    | 0.993            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.997            |
| 1 400                  | 0.994            |
| 1 600                  | 0.993            |
| 1 800                  | 0.986            |
| 2 000                  | 0.965            |
| 2 200                  | 0.910            |
| 2 400                  | 0.71             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 565   |
| Annealing Point AP (°C)                                          | 596   |
| Transformation Temperature Tg (°C)                               | 612   |
| Yield Point At (°C)                                              | 648   |
| Softening Point SP (°C)                                          | 679   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 60    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 74    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.828 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 48                                             |
| -90 ~ -80                               | 49                                             |
| -80 ~ -70                               | 50                                             |
| -70 ~ -60                               | 51                                             |
| -60 ~ -50                               | 52                                             |
| -50 ~ -40                               | 53                                             |
| -40 ~ -30                               | 54                                             |
| -30 ~ -20                               | 55                                             |
| -20 ~ -10                               | 57                                             |
| -10 ~ 0                                 | 58                                             |
| 0 ~ 10                                  | 59                                             |
| 10 ~ 20                                 | 60                                             |
| 20 ~ 30                                 | 61                                             |
| 30 ~ 40                                 | 62                                             |
| 40 ~ 50                                 | 62                                             |
| 50 ~ 60                                 | 63                                             |
| 60 ~ 70                                 | 64                                             |
| 70 ~ 80                                 | 65                                             |
| 80 ~ 90                                 | 66                                             |
| 90 ~ 100                                | 67                                             |
| 100 ~ 110                               | 68                                             |
| 110 ~ 120                               | 68                                             |
| 120 ~ 130                               | 69                                             |
| 130 ~ 140                               | 70                                             |
| 140 ~ 150                               | 71                                             |
| 150 ~ 160                               | 71                                             |
| 160 ~ 170                               | 72                                             |
| 170 ~ 180                               | 73                                             |
| 180 ~ 190                               | 73                                             |
| 190 ~ 200                               | 74                                             |
| 200 ~ 210                               | 75                                             |
| 210 ~ 220                               | 75                                             |
| 220 ~ 230                               | 76                                             |
| 230 ~ 240                               | 77                                             |
| 240 ~ 250                               | 77                                             |
| 250 ~ 260                               | 78                                             |
| 260 ~ 270                               | 78                                             |
| 270 ~ 280                               | 79                                             |
| 280 ~ 290                               | 79                                             |
| 290 ~ 300                               | 79                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.92 |
| Specific Gravity $d$                                     | 4.41 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |      |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |      |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i    |
| -80 ~ -60                                    | 4.2                                                             | 4.4 | 4.9 | 5.1 | 5.1 | 5.4 | 5.6 | 6.2 | 6.3 | 6.9 | 7.5  | 8.9  |
| -60 ~ -40                                    | 4.0                                                             | 4.3 | 4.8 | 5.0 | 5.0 | 5.3 | 5.5 | 6.1 | 6.1 | 6.9 | 7.5  | 9.0  |
| -40 ~ -20                                    | 4.1                                                             | 4.3 | 4.8 | 5.0 | 5.0 | 5.3 | 5.6 | 6.2 | 6.3 | 6.9 | 7.6  | 9.1  |
| -20 ~ 0                                      | 4.1                                                             | 4.3 | 4.9 | 5.1 | 5.2 | 5.4 | 5.7 | 6.3 | 6.4 | 7.1 | 7.9  | 9.3  |
| 0 ~ 20                                       | 4.2                                                             | 4.5 | 5.1 | 5.2 | 5.3 | 5.6 | 5.9 | 6.5 | 6.5 | 7.4 | 8.1  | 9.6  |
| 20 ~ 40                                      | 4.3                                                             | 4.6 | 5.3 | 5.4 | 5.5 | 5.8 | 6.1 | 6.7 | 6.8 | 7.5 | 8.3  | 10.0 |
| 40 ~ 60                                      | 4.5                                                             | 4.9 | 5.4 | 5.6 | 5.7 | 6.0 | 6.3 | 6.9 | 7.0 | 7.8 | 8.6  | 10.3 |
| 60 ~ 80                                      | 4.7                                                             | 5.0 | 5.6 | 5.7 | 5.8 | 6.1 | 6.4 | 7.1 | 7.3 | 8.0 | 8.9  | 10.6 |
| 80 ~ 100                                     | 4.8                                                             | 5.2 | 5.8 | 6.0 | 6.0 | 6.4 | 6.7 | 7.4 | 7.5 | 8.3 | 9.1  | 11.0 |
| 100 ~ 120                                    | 5.0                                                             | 5.3 | 6.0 | 6.2 | 6.2 | 6.6 | 6.9 | 7.6 | 7.7 | 8.5 | 9.4  | 11.2 |
| 120 ~ 140                                    | 5.1                                                             | 5.5 | 6.1 | 6.3 | 6.4 | 6.7 | 7.1 | 7.8 | 7.9 | 8.8 | 9.7  | 11.5 |
| 140 ~ 160                                    | 5.2                                                             | 5.6 | 6.2 | 6.5 | 6.5 | 6.9 | 7.2 | 8.0 | 8.1 | 9.0 | 9.9  | 11.9 |
| 160 ~ 180                                    | 5.3                                                             | 5.7 | 6.3 | 6.6 | 6.6 | 7.0 | 7.4 | 8.1 | 8.3 | 9.3 | 10.2 | 12.1 |

## S-LAH52Q

Code(d) **800422**  
Code(e) **804420**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.799 52</b><br>1.799 520 | Abbe Number $\nu_d$ | <b>42.24</b> | Dispersion $n_F - n_C$       | <b>0.018 928</b> |
| Refractive Index $n_e$ | 1.804 018                    | Abbe Number $\nu_e$ | 41.98        | Dispersion $n_{F'} - n_{C'}$ | 0.019 154        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.757 08 |
| $n_{1970}$         | 1.970 09  | 1.763 45 |
| $n_{1530}$         | 1.529 58  | 1.770 50 |
| $n_{1129}$         | 1.128 64  | 1.777 32 |
| $n_t$              | 1.013 98  | 1.779 80 |
| $n_s$              | 0.852 11  | 1.784 38 |
| $n_{A'}$           | 0.768 19  | 1.787 67 |
| $n_F$              | 0.706 52  | 1.790 76 |
| $n_C$              | 0.656 27  | 1.793 89 |
| $n_{C'}$           | 0.643 85  | 1.794 78 |
| $n_{He-Ne}$        | 0.632 8   | 1.795 61 |
| $n_D$              | 0.589 29  | 1.799 35 |
| $n_d$              | 0.587 56  | 1.799 52 |
| $n_e$              | 0.546 07  | 1.804 02 |
| $n_F$              | 0.486 13  | 1.812 82 |
| $n_{F'}$           | 0.479 99  | 1.813 93 |
| $n_{He-Cd}$        | 0.441 57  | 1.822 12 |
| $n_g$              | 0.435 835 | 1.823 56 |
| $n_h$              | 0.404 656 | 1.832 71 |
| $n_i$              | 0.365 015 | 1.848 83 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.910 823 18E+00 |
| $A_2$                           | 2.398 545 89E-01 |
| $A_3$                           | 1.161 597 33E+00 |
| $B_1$                           | 1.035 653 52E-02 |
| $B_2$                           | 4.138 050 81E-02 |
| $B_3$                           | 9.660 373 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 109.8 |
| Rigidity Modulus G (GPa) | 41.8  |
| Poisson's Ratio $\sigma$ | 0.313 |
| Knoop Hardness Hk[Class] | 620   |
| Abrasion Aa              | 66    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.014 094 |
| $n_C - n_{A'}$      | 0.006 224 |
| $n_d - n_C$         | 0.005 627 |
| $n_e - n_C$         | 0.010 125 |
| $n_g - n_d$         | 0.024 043 |
| $n_g - n_F$         | 0.010 742 |
| $n_h - n_g$         | 0.009 149 |
| $n_i - n_g$         | 0.025 268 |
| $n_{C'} - n_t$      | 0.014 980 |
| $n_e - n_{C'}$      | 0.009 239 |
| $n_{F'} - n_e$      | 0.009 915 |
| $n_i - n_{F'}$      | 0.034 898 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.744 6 |
| $\theta_{C,A'}$              | 0.328 8 |
| $\theta_{d,C}$               | 0.297 3 |
| $\theta_{e,C}$               | 0.534 9 |
| $\theta_{g,d}$               | 1.270 2 |
| $\theta_{g,F}$               | 0.567 5 |
| $\theta_{h,g}$               | 0.483 4 |
| $\theta_{i,g}$               | 1.335 0 |
| $\theta'_{C,t}$              | 0.782 1 |
| $\theta'_{e,C'}$             | 0.482 4 |
| $\theta'_{F,e}$              | 0.517 6 |
| $\theta'_{i,F'}$             | 1.822 0 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.000 3 |
| $\Delta\theta_{C,A'}$ | 0.001 7  |
| $\Delta\theta_{g,d}$  | -0.006 8 |
| $\Delta\theta_{g,F}$  | -0.005 6 |
| $\Delta\theta_{i,g}$  | -0.036 3 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 390  | $\lambda_5$      | 335 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 365  | $\lambda_{0.05}$ | 334 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.67 | 0.68             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.13             |
| 350                    | 0.46             |
| 360                    | 0.73             |
| 370                    | 0.86             |
| 380                    | 0.926            |
| 390                    | 0.954            |
| 400                    | 0.969            |
| 420                    | 0.982            |
| 440                    | 0.988            |
| 460                    | 0.992            |
| 480                    | 0.995            |
| 500                    | 0.997            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.989            |
| 2 000                  | 0.967            |
| 2 200                  | 0.924            |
| 2 400                  | 0.75             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 553   |
| Annealing Point AP (°C)                                          | 576   |
| Transformation Temperature Tg (°C)                               | 596   |
| Yield Point At (°C)                                              | 627   |
| Softening Point SP (°C)                                          | 651   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 63    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 76    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.852 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 48                                             |
| -90 ~ -80                               | 50                                             |
| -80 ~ -70                               | 51                                             |
| -70 ~ -60                               | 52                                             |
| -60 ~ -50                               | 54                                             |
| -50 ~ -40                               | 55                                             |
| -40 ~ -30                               | 56                                             |
| -30 ~ -20                               | 57                                             |
| -20 ~ -10                               | 59                                             |
| -10 ~ 0                                 | 60                                             |
| 0 ~ 10                                  | 61                                             |
| 10 ~ 20                                 | 62                                             |
| 20 ~ 30                                 | 63                                             |
| 30 ~ 40                                 | 64                                             |
| 40 ~ 50                                 | 65                                             |
| 50 ~ 60                                 | 66                                             |
| 60 ~ 70                                 | 67                                             |
| 70 ~ 80                                 | 68                                             |
| 80 ~ 90                                 | 69                                             |
| 90 ~ 100                                | 70                                             |
| 100 ~ 110                               | 71                                             |
| 110 ~ 120                               | 71                                             |
| 120 ~ 130                               | 72                                             |
| 130 ~ 140                               | 73                                             |
| 140 ~ 150                               | 74                                             |
| 150 ~ 160                               | 74                                             |
| 160 ~ 170                               | 75                                             |
| 170 ~ 180                               | 76                                             |
| 180 ~ 190                               | 76                                             |
| 190 ~ 200                               | 77                                             |
| 200 ~ 210                               | 77                                             |
| 210 ~ 220                               | 78                                             |
| 220 ~ 230                               | 78                                             |
| 230 ~ 240                               | 79                                             |
| 240 ~ 250                               | 79                                             |
| 250 ~ 260                               | 80                                             |
| 260 ~ 270                               | 80                                             |
| 270 ~ 280                               | 80                                             |
| 280 ~ 290                               | 81                                             |
| 290 ~ 300                               | 81                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.31 |
| Specific Gravity $d$                                     | 4.47 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|------|------|------|------|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |      |      |      |      |      |      |      |      |      |      |
|                                              | 1550                                                            | t   | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | 7.2                                                             | 7.5 | 8.2  | 8.4  | 8.4  | 8.8  | 9.1  | 9.8  | 9.9  | 10.7 | 11.4 | 13.1 |
| -60 ~ -40                                    | 7.1                                                             | 7.4 | 8.1  | 8.3  | 8.4  | 8.7  | 9.0  | 9.7  | 9.9  | 10.7 | 11.5 | 13.2 |
| -40 ~ -20                                    | 7.1                                                             | 7.5 | 8.1  | 8.3  | 8.4  | 8.7  | 9.1  | 9.8  | 9.9  | 10.8 | 11.6 | 13.3 |
| -20 ~ 0                                      | 7.2                                                             | 7.5 | 8.3  | 8.5  | 8.6  | 8.9  | 9.3  | 10.0 | 10.1 | 10.9 | 11.9 | 13.6 |
| 0 ~ 20                                       | 7.3                                                             | 7.7 | 8.4  | 8.6  | 8.7  | 9.1  | 9.4  | 10.1 | 10.2 | 11.1 | 12.1 | 13.9 |
| 20 ~ 40                                      | 7.5                                                             | 7.8 | 8.6  | 8.9  | 8.9  | 9.3  | 9.7  | 10.4 | 10.5 | 11.5 | 12.4 | 14.3 |
| 40 ~ 60                                      | 7.6                                                             | 8.0 | 8.8  | 9.1  | 9.1  | 9.5  | 9.9  | 10.7 | 10.8 | 11.7 | 12.7 | 14.7 |
| 60 ~ 80                                      | 7.9                                                             | 8.3 | 9.0  | 9.3  | 9.3  | 9.7  | 10.1 | 10.9 | 11.2 | 12.1 | 13.1 | 15.1 |
| 80 ~ 100                                     | 8.1                                                             | 8.5 | 9.2  | 9.5  | 9.6  | 10.0 | 10.4 | 11.2 | 11.3 | 12.3 | 13.4 | 15.5 |
| 100 ~ 120                                    | 8.3                                                             | 8.7 | 9.5  | 9.7  | 9.8  | 10.2 | 10.7 | 11.5 | 11.6 | 12.7 | 13.7 | 15.8 |
| 120 ~ 140                                    | 8.4                                                             | 8.9 | 9.7  | 9.9  | 10.0 | 10.5 | 10.9 | 11.8 | 11.9 | 13.0 | 14.0 | 16.1 |
| 140 ~ 160                                    | 8.6                                                             | 9.0 | 9.9  | 10.1 | 10.2 | 10.7 | 11.1 | 12.0 | 12.1 | 13.2 | 14.3 | 16.6 |
| 160 ~ 180                                    | 8.7                                                             | 9.1 | 10.0 | 10.3 | 10.4 | 10.8 | 11.3 | 12.2 | 12.4 | 13.5 | 14.7 | 16.9 |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.806 10<br>1.806 098 | Abbe Number $\nu_d$ | 40.92 | Dispersion $n_F - n_C$       | 0.019 697 |
| Refractive Index $n_e$ | 1.810 775             | Abbe Number $\nu_e$ | 40.67 | Dispersion $n_{F'} - n_{C'}$ | 0.019 935 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.760 51 |
| $n_{1970}$         | 1.970 09  | 1.767 64 |
| $n_{1530}$         | 1.529 58  | 1.775 46 |
| $n_{1129}$         | 1.128 64  | 1.782 87 |
| $n_t$              | 1.013 98  | 1.785 51 |
| $n_s$              | 0.852 11  | 1.790 34 |
| $n_{A'}$           | 0.768 19  | 1.793 77 |
| $n_F$              | 0.706 52  | 1.796 99 |
| $n_C$              | 0.656 27  | 1.800 25 |
| $n_{C'}$           | 0.643 85  | 1.801 17 |
| $n_{He-Ne}$        | 0.632 8   | 1.802 03 |
| $n_D$              | 0.589 29  | 1.805 92 |
| $n_d$              | 0.587 56  | 1.806 10 |
| $n_e$              | 0.546 07  | 1.810 78 |
| $n_F$              | 0.486 13  | 1.819 94 |
| $n_{F'}$           | 0.479 99  | 1.821 10 |
| $n_{He-Cd}$        | 0.441 57  | 1.829 67 |
| $n_g$              | 0.435 835 | 1.831 17 |
| $n_h$              | 0.404 656 | 1.840 78 |
| $n_i$              | 0.365 015 | 1.857 82 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.918 116 19E+00 |
| $A_2$                           | 2.537 243 99E-01 |
| $A_3$                           | 1.394 738 85E+00 |
| $B_1$                           | 1.021 476 84E-02 |
| $B_2$                           | 4.331 760 11E-02 |
| $B_3$                           | 1.019 380 21E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 4,2 |
| Phosphate Resistance PR                   | 2,0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 112.7 |
| Rigidity Modulus G (GPa) | 43.4  |
| Poisson's Ratio $\sigma$ | 0.299 |
| Knoop Hardness Hk[Class] | 650 7 |
| Abrasion Aa              | 80    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.014 740 |
| $n_C - n_{A'}$      | 0.006 479 |
| $n_d - n_C$         | 0.005 850 |
| $n_e - n_C$         | 0.010 527 |
| $n_g - n_d$         | 0.025 076 |
| $n_g - n_F$         | 0.011 229 |
| $n_h - n_g$         | 0.009 607 |
| $n_i - n_g$         | 0.026 650 |
| $n_{C'} - n_t$      | 0.015 661 |
| $n_e - n_{C'}$      | 0.009 606 |
| $n_{F'} - n_e$      | 0.010 329 |
| $n_i - n_{F'}$      | 0.036 720 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.748 3 |
| $\theta_{C,A'}$              | 0.328 9 |
| $\theta_{d,C}$               | 0.297 0 |
| $\theta_{e,C}$               | 0.534 4 |
| $\theta_{g,d}$               | 1.273 1 |
| $\theta_{g,F}$               | 0.570 1 |
| $\theta_{h,g}$               | 0.487 7 |
| $\theta_{i,g}$               | 1.353 0 |
| $\theta'_{C,t}$              | 0.785 6 |
| $\theta'_{e,C'}$             | 0.481 9 |
| $\theta'_{F,e}$              | 0.518 1 |
| $\theta'_{i,F'}$             | 1.842 0 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.009 6  |
| $\Delta\theta_{C,A'}$ | 0.003 4  |
| $\Delta\theta_{g,d}$  | -0.006 6 |
| $\Delta\theta_{g,F}$  | -0.005 2 |
| $\Delta\theta_{i,g}$  | -0.029 4 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 405  | $\lambda_5$      | 340 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 370  | $\lambda_{0.05}$ | 340 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.07 | 1.13             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.06             |
| 350                    | 0.38             |
| 360                    | 0.65             |
| 370                    | 0.80             |
| 380                    | 0.88             |
| 390                    | 0.925            |
| 400                    | 0.947            |
| 420                    | 0.969            |
| 440                    | 0.979            |
| 460                    | 0.985            |
| 480                    | 0.989            |
| 500                    | 0.993            |
| 550                    | 0.996            |
| 600                    | 0.996            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.989            |
| 2 000                  | 0.969            |
| 2 200                  | 0.915            |
| 2 400                  | 0.72             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 611   |
| Yield Point At (°C)                                              | 648   |
| Softening Point SP (°C)                                          | 687   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 59    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 73    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.860 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 46                                             |
| -90 ~ -80                               | 47                                             |
| -80 ~ -70                               | 48                                             |
| -70 ~ -60                               | 49                                             |
| -60 ~ -50                               | 51                                             |
| -50 ~ -40                               | 52                                             |
| -40 ~ -30                               | 53                                             |
| -30 ~ -20                               | 54                                             |
| -20 ~ -10                               | 55                                             |
| -10 ~ 0                                 | 56                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 60                                             |
| 40 ~ 50                                 | 61                                             |
| 50 ~ 60                                 | 62                                             |
| 60 ~ 70                                 | 63                                             |
| 70 ~ 80                                 | 64                                             |
| 80 ~ 90                                 | 65                                             |
| 90 ~ 100                                | 66                                             |
| 100 ~ 110                               | 67                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 69                                             |
| 140 ~ 150                               | 70                                             |
| 150 ~ 160                               | 70                                             |
| 160 ~ 170                               | 71                                             |
| 170 ~ 180                               | 72                                             |
| 180 ~ 190                               | 72                                             |
| 190 ~ 200                               | 73                                             |
| 200 ~ 210                               | 73                                             |
| 210 ~ 220                               | 74                                             |
| 220 ~ 230                               | 75                                             |
| 230 ~ 240                               | 75                                             |
| 240 ~ 250                               | 76                                             |
| 250 ~ 260                               | 76                                             |
| 260 ~ 270                               | 76                                             |
| 270 ~ 280                               | 77                                             |
| 280 ~ 290                               | 77                                             |
| 290 ~ 300                               | 78                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.96 |
| Specific Gravity $d$                                     | 4.43 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |      |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |      |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i    |
| -80 ~ -60                                    | 4.2                                                             | 4.5 | 5.0 | 5.2 | 5.2 | 5.5 | 5.7 | 6.3 | 6.4 | 7.0 | 7.8  | 9.2  |
| -60 ~ -40                                    | 4.1                                                             | 4.4 | 4.9 | 5.1 | 5.2 | 5.4 | 5.7 | 6.3 | 6.4 | 7.1 | 7.8  | 9.4  |
| -40 ~ -20                                    | 4.2                                                             | 4.4 | 4.9 | 5.1 | 5.2 | 5.5 | 5.8 | 6.4 | 6.5 | 7.2 | 7.9  | 9.6  |
| -20 ~ 0                                      | 4.2                                                             | 4.5 | 5.1 | 5.3 | 5.3 | 5.6 | 5.9 | 6.5 | 6.6 | 7.4 | 8.2  | 9.8  |
| 0 ~ 20                                       | 4.3                                                             | 4.7 | 5.2 | 5.4 | 5.5 | 5.8 | 6.1 | 6.7 | 6.8 | 7.7 | 8.5  | 10.1 |
| 20 ~ 40                                      | 4.5                                                             | 4.8 | 5.3 | 5.6 | 5.7 | 6.0 | 6.3 | 6.9 | 7.0 | 7.9 | 8.7  | 10.5 |
| 40 ~ 60                                      | 4.6                                                             | 5.0 | 5.6 | 5.8 | 5.9 | 6.2 | 6.5 | 7.2 | 7.3 | 8.1 | 9.0  | 10.9 |
| 60 ~ 80                                      | 4.8                                                             | 5.1 | 5.7 | 5.9 | 6.0 | 6.3 | 6.7 | 7.5 | 7.6 | 8.5 | 9.4  | 11.2 |
| 80 ~ 100                                     | 5.0                                                             | 5.3 | 5.9 | 6.1 | 6.2 | 6.5 | 6.9 | 7.6 | 7.7 | 8.6 | 9.6  | 11.6 |
| 100 ~ 120                                    | 5.1                                                             | 5.4 | 6.1 | 6.3 | 6.4 | 6.7 | 7.1 | 7.9 | 7.9 | 8.9 | 9.9  | 11.8 |
| 120 ~ 140                                    | 5.2                                                             | 5.5 | 6.2 | 6.5 | 6.5 | 6.9 | 7.3 | 8.0 | 8.1 | 9.1 | 10.1 | 12.1 |
| 140 ~ 160                                    | 5.3                                                             | 5.6 | 6.3 | 6.6 | 6.6 | 7.0 | 7.4 | 8.2 | 8.3 | 9.3 | 10.3 | 12.5 |
| 160 ~ 180                                    | 5.3                                                             | 5.7 | 6.4 | 6.6 | 6.7 | 7.1 | 7.5 | 8.3 | 8.5 | 9.5 | 10.6 | 12.8 |

## S-LAH53V

Code(d) **806409**  
Code(e) **811407**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.806 10</b><br>1.806 100 | Abbe Number $\nu_d$ | <b>40.93</b> | Dispersion $n_F - n_C$       | <b>0.019 695</b> |
| Refractive Index $n_e$ | 1.810 776                    | Abbe Number $\nu_e$ | 40.67        | Dispersion $n_{F'} - n_{C'}$ | 0.019 937        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.762 01 |
| $n_{1970}$         | 1.970 09  | 1.768 65 |
| $n_{1530}$         | 1.529 58  | 1.776 00 |
| $n_{1129}$         | 1.128 64  | 1.783 09 |
| $n_t$              | 1.013 98  | 1.785 66 |
| $n_s$              | 0.852 11  | 1.790 41 |
| $n_{A'}$           | 0.768 19  | 1.793 81 |
| $n_F$              | 0.706 52  | 1.797 01 |
| $n_C$              | 0.656 27  | 1.800 26 |
| $n_{C'}$           | 0.643 85  | 1.801 18 |
| $n_{He-Ne}$        | 0.632 8   | 1.802 04 |
| $n_D$              | 0.589 29  | 1.805 93 |
| $n_d$              | 0.587 56  | 1.806 10 |
| $n_e$              | 0.546 07  | 1.810 78 |
| $n_F$              | 0.486 13  | 1.819 95 |
| $n_{F'}$           | 0.479 99  | 1.821 11 |
| $n_{He-Cd}$        | 0.441 57  | 1.829 69 |
| $n_g$              | 0.435 835 | 1.831 21 |
| $n_h$              | 0.404 656 | 1.840 84 |
| $n_i$              | 0.365 015 | 1.857 98 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.966 009 55E+00 |
| $A_2$                           | 2.051 433 05E-01 |
| $A_3$                           | 1.232 009 34E+00 |
| $B_1$                           | 1.078 177 85E-02 |
| $B_2$                           | 4.637 278 69E-02 |
| $B_3$                           | 9.769 406 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 113.5 |   |
| Rigidity Modulus G (GPa) | 43.4  |   |
| Poisson's Ratio $\sigma$ | 0.309 |   |
| Knoop Hardness Hk[Class] | 650   | 7 |
| Abrasion Aa              | 66    |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.014 601 |
| $n_C - n_{A'}$      | 0.006 450 |
| $n_d - n_C$         | 0.005 841 |
| $n_e - n_C$         | 0.010 517 |
| $n_g - n_d$         | 0.025 106 |
| $n_g - n_F$         | 0.011 252 |
| $n_h - n_g$         | 0.009 639 |
| $n_i - n_g$         | 0.026 774 |
| $n_{C'} - n_t$      | 0.015 520 |
| $n_e - n_{C'}$      | 0.009 598 |
| $n_{F'} - n_e$      | 0.010 339 |
| $n_i - n_{F'}$      | 0.036 865 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.741 4 |
| $\theta_{C,A'}$              | 0.327 5 |
| $\theta_{d,C}$               | 0.296 6 |
| $\theta_{e,C}$               | 0.534 0 |
| $\theta_{g,d}$               | 1.274 7 |
| $\theta_{g,F}$               | 0.571 3 |
| $\theta_{h,g}$               | 0.489 4 |
| $\theta_{i,g}$               | 1.359 4 |
| $\theta'_{C,t}$              | 0.778 5 |
| $\theta'_{e,C'}$             | 0.481 4 |
| $\theta'_{F,e}$              | 0.518 6 |
| $\theta'_{i,F'}$             | 1.849 1 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.002 7  |
| $\Delta\theta_{C,A'}$ | 0.002 0  |
| $\Delta\theta_{g,d}$  | -0.005 0 |
| $\Delta\theta_{g,F}$  | -0.003 9 |
| $\Delta\theta_{i,g}$  | -0.022 9 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 400  | $\lambda_5$      | 345 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 372  | $\lambda_{0.05}$ | 341 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.95 | 0.98             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.02             |
| 350                    | 0.23             |
| 360                    | 0.56             |
| 370                    | 0.78             |
| 380                    | 0.88             |
| 390                    | 0.931            |
| 400                    | 0.954            |
| 420                    | 0.975            |
| 440                    | 0.984            |
| 460                    | 0.989            |
| 480                    | 0.992            |
| 500                    | 0.995            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.996            |
| 1 600                  | 0.995            |
| 1 800                  | 0.987            |
| 2 000                  | 0.966            |
| 2 200                  | 0.916            |
| 2 400                  | 0.73             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 569   |
| Annealing Point AP (°C)                                          | 589   |
| Transformation Temperature Tg (°C)                               | 610   |
| Yield Point At (°C)                                              | 645   |
| Softening Point SP (°C)                                          | 670   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 60    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 76    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.859 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 46                                             |
| -90 ~ -80                               | 47                                             |
| -80 ~ -70                               | 48                                             |
| -70 ~ -60                               | 50                                             |
| -60 ~ -50                               | 51                                             |
| -50 ~ -40                               | 52                                             |
| -40 ~ -30                               | 53                                             |
| -30 ~ -20                               | 55                                             |
| -20 ~ -10                               | 56                                             |
| -10 ~ 0                                 | 57                                             |
| 0 ~ 10                                  | 58                                             |
| 10 ~ 20                                 | 59                                             |
| 20 ~ 30                                 | 61                                             |
| 30 ~ 40                                 | 62                                             |
| 40 ~ 50                                 | 63                                             |
| 50 ~ 60                                 | 64                                             |
| 60 ~ 70                                 | 65                                             |
| 70 ~ 80                                 | 66                                             |
| 80 ~ 90                                 | 67                                             |
| 90 ~ 100                                | 68                                             |
| 100 ~ 110                               | 69                                             |
| 110 ~ 120                               | 70                                             |
| 120 ~ 130                               | 70                                             |
| 130 ~ 140                               | 71                                             |
| 140 ~ 150                               | 72                                             |
| 150 ~ 160                               | 73                                             |
| 160 ~ 170                               | 74                                             |
| 170 ~ 180                               | 74                                             |
| 180 ~ 190                               | 75                                             |
| 190 ~ 200                               | 76                                             |
| 200 ~ 210                               | 77                                             |
| 210 ~ 220                               | 77                                             |
| 220 ~ 230                               | 78                                             |
| 230 ~ 240                               | 79                                             |
| 240 ~ 250                               | 79                                             |
| 250 ~ 260                               | 80                                             |
| 260 ~ 270                               | 80                                             |
| 270 ~ 280                               | 81                                             |
| 280 ~ 290                               | 81                                             |
| 290 ~ 300                               | 82                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.13 |
| Specific Gravity $d$                                     | 4.41 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |      |      |      |      |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | 6.2                                                             | 6.4 | 7.1 | 7.3 | 7.3 | 7.6 | 7.9 | 8.6  | 8.7  | 9.5  | 10.3 | 12.0 |
| -60 ~ -40                                    | 6.1                                                             | 6.4 | 7.1 | 7.3 | 7.3 | 7.6 | 7.9 | 8.7  | 8.7  | 9.5  | 10.4 | 12.2 |
| -40 ~ -20                                    | 6.2                                                             | 6.5 | 7.1 | 7.3 | 7.4 | 7.8 | 8.1 | 8.8  | 8.9  | 9.7  | 10.6 | 12.4 |
| -20 ~ 0                                      | 6.3                                                             | 6.6 | 7.3 | 7.5 | 7.6 | 7.9 | 8.3 | 9.0  | 9.1  | 10.0 | 10.9 | 12.7 |
| 0 ~ 20                                       | 6.5                                                             | 6.9 | 7.5 | 7.7 | 7.8 | 8.1 | 8.5 | 9.2  | 9.3  | 10.3 | 11.2 | 13.1 |
| 20 ~ 40                                      | 6.7                                                             | 7.0 | 7.8 | 8.0 | 8.0 | 8.4 | 8.7 | 9.5  | 9.6  | 10.5 | 11.5 | 13.5 |
| 40 ~ 60                                      | 6.8                                                             | 7.3 | 7.9 | 8.2 | 8.2 | 8.6 | 9.0 | 9.7  | 9.8  | 10.8 | 11.7 | 13.8 |
| 60 ~ 80                                      | 7.0                                                             | 7.4 | 8.1 | 8.3 | 8.4 | 8.8 | 9.1 | 9.9  | 10.1 | 11.1 | 12.1 | 14.2 |
| 80 ~ 100                                     | 7.2                                                             | 7.6 | 8.3 | 8.5 | 8.6 | 9.0 | 9.4 | 10.2 | 10.3 | 11.3 | 12.4 | 14.6 |
| 100 ~ 120                                    | 7.3                                                             | 7.7 | 8.5 | 8.7 | 8.8 | 9.2 | 9.6 | 10.4 | 10.5 | 11.5 | 12.6 | 14.8 |
| 120 ~ 140                                    | 7.4                                                             | 7.8 | 8.6 | 8.8 | 8.9 | 9.3 | 9.7 | 10.6 | 10.7 | 11.7 | 12.9 | 15.1 |
| 140 ~ 160                                    | 7.5                                                             | 7.9 | 8.6 | 8.9 | 9.0 | 9.4 | 9.8 | 10.7 | 10.8 | 11.9 | 13.0 | 15.4 |
| 160 ~ 180                                    | 7.5                                                             | 7.9 | 8.7 | 8.9 | 9.0 | 9.4 | 9.9 | 10.8 | 11.0 | 12.1 | 13.3 | 15.6 |

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## S-LAH55V

Code(d) **835427**  
Code(e) **839425**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.834 81</b><br>1.834 807 | Abbe Number $\nu_d$ | <b>42.73</b> | Dispersion $n_F - n_C$       | <b>0.019 539</b> |
| Refractive Index $n_e$ | 1.839 452                    | Abbe Number $\nu_e$ | 42.47        | Dispersion $n_{F'} - n_{C'}$ | 0.019 764        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.788 70 |
| $n_{1970}$         | 1.970 09  | 1.796 02 |
| $n_{1530}$         | 1.529 58  | 1.804 02 |
| $n_{1129}$         | 1.128 64  | 1.811 54 |
| $n_t$              | 1.013 98  | 1.814 20 |
| $n_s$              | 0.852 11  | 1.819 06 |
| $n_{A'}$           | 0.768 19  | 1.822 50 |
| $n_F$              | 0.706 52  | 1.825 72 |
| $n_C$              | 0.656 27  | 1.828 98 |
| $n_{C'}$           | 0.643 85  | 1.829 90 |
| $n_{He-Ne}$        | 0.632 8   | 1.830 76 |
| $n_D$              | 0.589 29  | 1.834 64 |
| $n_d$              | 0.587 56  | 1.834 81 |
| $n_e$              | 0.546 07  | 1.839 45 |
| $n_F$              | 0.486 13  | 1.848 52 |
| $n_{F'}$           | 0.479 99  | 1.849 66 |
| $n_{He-Cd}$        | 0.441 57  | 1.858 08 |
| $n_g$              | 0.435 835 | 1.859 56 |
| $n_h$              | 0.404 656 | 1.868 93 |
| $n_i$              | 0.365 015 | 1.885 39 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.970 253 25E+00 |
| $A_2$                           | 3.048 941 40E-01 |
| $A_3$                           | 1.392 146 65E+00 |
| $B_1$                           | 9.910 881 34E-03 |
| $B_2$                           | 3.832 022 95E-02 |
| $B_3$                           | 9.777 852 49E+01 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 2   |
| Weathering Resistance(Surface) Group W(S) | 4   |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 117.8 |
| Rigidity Modulus G (GPa) | 47.0  |
| Poisson's Ratio $\sigma$ | 0.253 |
| Knoop Hardness Hk[Class] | 720   |
| Abrasion Aa              | 63    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.014 778 |
| $n_C - n_{A'}$      | 0.006 476 |
| $n_d - n_C$         | 0.005 826 |
| $n_e - n_C$         | 0.010 471 |
| $n_g - n_d$         | 0.024 749 |
| $n_g - n_F$         | 0.011 036 |
| $n_h - n_g$         | 0.009 373 |
| $n_i - n_g$         | 0.025 830 |
| $n_{C'} - n_t$      | 0.015 697 |
| $n_e - n_{C'}$      | 0.009 552 |
| $n_{F'} - n_e$      | 0.010 212 |
| $n_i - n_{F'}$      | 0.035 722 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.756 3 |
| $\theta_{C,A'}$              | 0.331 4 |
| $\theta_{d,C}$               | 0.298 2 |
| $\theta_{e,C}$               | 0.535 9 |
| $\theta_{g,d}$               | 1.266 6 |
| $\theta_{g,F}$               | 0.564 8 |
| $\theta_{h,g}$               | 0.479 7 |
| $\theta_{i,g}$               | 1.322 0 |
| $\theta'_{C,t}$              | 0.794 2 |
| $\theta'_{e,C'}$             | 0.483 3 |
| $\theta'_{F,e}$              | 0.516 7 |
| $\theta'_{i,F'}$             | 1.807 4 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.009 1  |
| $\Delta\theta_{C,A'}$ | 0.003 7  |
| $\Delta\theta_{g,d}$  | -0.009 4 |
| $\Delta\theta_{g,F}$  | -0.007 5 |
| $\Delta\theta_{i,g}$  | -0.045 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 400  | $\lambda_5$      | 325 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 363  | $\lambda_{0.05}$ | 327 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.93 | 0.96             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.14             |
| 340                    | 0.42             |
| 350                    | 0.64             |
| 360                    | 0.78             |
| 370                    | 0.86             |
| 380                    | 0.910            |
| 390                    | 0.939            |
| 400                    | 0.956            |
| 420                    | 0.974            |
| 440                    | 0.982            |
| 460                    | 0.987            |
| 480                    | 0.992            |
| 500                    | 0.995            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.995            |
| 1 800                  | 0.987            |
| 2 000                  | 0.966            |
| 2 200                  | 0.909            |
| 2 400                  | 0.71             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 645   |
| Annealing Point AP (°C)                                          | 672   |
| Transformation Temperature Tg (°C)                               | 697   |
| Yield Point At (°C)                                              | 717   |
| Softening Point SP (°C)                                          | 749   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 65    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 78    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.853 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 52                                             |
| -90 ~ -80                               | 53                                             |
| -80 ~ -70                               | 54                                             |
| -70 ~ -60                               | 55                                             |
| -60 ~ -50                               | 56                                             |
| -50 ~ -40                               | 58                                             |
| -40 ~ -30                               | 59                                             |
| -30 ~ -20                               | 60                                             |
| -20 ~ -10                               | 61                                             |
| -10 ~ 0                                 | 62                                             |
| 0 ~ 10                                  | 63                                             |
| 10 ~ 20                                 | 64                                             |
| 20 ~ 30                                 | 65                                             |
| 30 ~ 40                                 | 66                                             |
| 40 ~ 50                                 | 67                                             |
| 50 ~ 60                                 | 68                                             |
| 60 ~ 70                                 | 68                                             |
| 70 ~ 80                                 | 69                                             |
| 80 ~ 90                                 | 70                                             |
| 90 ~ 100                                | 71                                             |
| 100 ~ 110                               | 72                                             |
| 110 ~ 120                               | 72                                             |
| 120 ~ 130                               | 73                                             |
| 130 ~ 140                               | 74                                             |
| 140 ~ 150                               | 75                                             |
| 150 ~ 160                               | 75                                             |
| 160 ~ 170                               | 76                                             |
| 170 ~ 180                               | 77                                             |
| 180 ~ 190                               | 77                                             |
| 190 ~ 200                               | 78                                             |
| 200 ~ 210                               | 78                                             |
| 210 ~ 220                               | 79                                             |
| 220 ~ 230                               | 79                                             |
| 230 ~ 240                               | 80                                             |
| 240 ~ 250                               | 80                                             |
| 250 ~ 260                               | 81                                             |
| 260 ~ 270                               | 81                                             |
| 270 ~ 280                               | 82                                             |
| 280 ~ 290                               | 82                                             |
| 290 ~ 300                               | 82                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.30 |
| Specific Gravity $d$                                     | 4.73 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 2.8                                                             | 3.0 | 3.3 | 3.4 | 3.6 | 3.7 | 3.9 | 4.3 | 4.4 | 5.0 | 5.5 | 6.6  |
| -60 ~ -40                                    | 2.5                                                             | 2.7 | 3.1 | 3.2 | 3.3 | 3.6 | 3.8 | 4.2 | 4.3 | 4.8 | 5.5 | 6.5  |
| -40 ~ -20                                    | 2.4                                                             | 2.6 | 3.1 | 3.2 | 3.3 | 3.5 | 3.7 | 4.2 | 4.3 | 4.9 | 5.5 | 6.7  |
| -20 ~ 0                                      | 2.4                                                             | 2.6 | 3.1 | 3.2 | 3.2 | 3.5 | 3.7 | 4.4 | 4.4 | 5.0 | 5.7 | 7.1  |
| 0 ~ 20                                       | 2.4                                                             | 2.6 | 3.1 | 3.3 | 3.3 | 3.6 | 3.9 | 4.5 | 4.5 | 5.3 | 6.0 | 7.3  |
| 20 ~ 40                                      | 2.5                                                             | 2.7 | 3.3 | 3.4 | 3.5 | 3.8 | 4.0 | 4.6 | 4.7 | 5.4 | 6.3 | 7.8  |
| 40 ~ 60                                      | 2.6                                                             | 2.8 | 3.4 | 3.6 | 3.6 | 3.9 | 4.2 | 4.9 | 5.0 | 5.8 | 6.6 | 8.2  |
| 60 ~ 80                                      | 2.6                                                             | 2.9 | 3.5 | 3.7 | 3.8 | 4.1 | 4.5 | 5.2 | 5.3 | 6.1 | 6.9 | 8.6  |
| 80 ~ 100                                     | 2.8                                                             | 3.1 | 3.7 | 3.9 | 4.0 | 4.3 | 4.7 | 5.4 | 5.5 | 6.5 | 7.3 | 9.1  |
| 100 ~ 120                                    | 2.9                                                             | 3.3 | 3.9 | 4.2 | 4.2 | 4.6 | 4.9 | 5.7 | 5.8 | 6.7 | 7.6 | 9.6  |
| 120 ~ 140                                    | 3.1                                                             | 3.4 | 4.1 | 4.4 | 4.4 | 4.8 | 5.2 | 6.0 | 6.1 | 7.0 | 8.0 | 10.1 |
| 140 ~ 160                                    | 3.2                                                             | 3.6 | 4.3 | 4.5 | 4.6 | 5.0 | 5.4 | 6.2 | 6.3 | 7.3 | 8.5 | 10.5 |
| 160 ~ 180                                    | 3.3                                                             | 3.7 | 4.5 | 4.8 | 4.9 | 5.3 | 5.7 | 6.6 | 6.7 | 7.8 | 8.8 | 11.0 |

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## S-LAH55VS

Code(d) 835427  
Code(e) 839425

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.834 81<br>1.834 810 | Abbe Number $\nu_d$ | 42.74 | Dispersion $n_F - n_C$       | 0.019 531 |
| Refractive Index $n_e$ | 1.839 452             | Abbe Number $\nu_e$ | 42.49 | Dispersion $n_{F'} - n_{C'}$ | 0.019 756 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.789 45 |
| $n_{1970}$         | 1.970 09  | 1.796 52 |
| $n_{1530}$         | 1.529 58  | 1.804 27 |
| $n_{1129}$         | 1.128 64  | 1.811 64 |
| $n_t$              | 1.013 98  | 1.814 28 |
| $n_s$              | 0.852 11  | 1.819 10 |
| $n_{A'}$           | 0.768 19  | 1.822 53 |
| $n_F$              | 0.706 52  | 1.825 74 |
| $n_C$              | 0.656 27  | 1.828 99 |
| $n_{C'}$           | 0.643 85  | 1.829 91 |
| $n_{He-Ne}$        | 0.632 8   | 1.830 77 |
| $n_D$              | 0.589 29  | 1.834 64 |
| $n_d$              | 0.587 56  | 1.834 81 |
| $n_e$              | 0.546 07  | 1.839 45 |
| $n_F$              | 0.486 13  | 1.848 52 |
| $n_{F'}$           | 0.479 99  | 1.849 66 |
| $n_{He-Cd}$        | 0.441 57  | 1.858 07 |
| $n_g$              | 0.435 835 | 1.859 55 |
| $n_h$              | 0.404 656 | 1.868 92 |
| $n_i$              | 0.365 015 | 1.885 34 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.925 910 95E+00 |
| $A_2$                           | 3.489 534 60E-01 |
| $A_3$                           | 1.422 307 44E+00 |
| $B_1$                           | 9.611 524 90E-03 |
| $B_2$                           | 3.651 329 80E-02 |
| $B_3$                           | 1.033 640 90E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 2   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 122.3 |
| Rigidity Modulus G (GPa) | 47.2  |
| Poisson's Ratio $\sigma$ | 0.297 |
| Knoop Hardness Hk[Class] | 730 7 |
| Abrasion Aa              | 60    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.014 712 |
| $n_C - n_{A'}$      | 0.006 462 |
| $n_d - n_C$         | 0.005 822 |
| $n_e - n_C$         | 0.010 464 |
| $n_g - n_d$         | 0.024 741 |
| $n_g - n_F$         | 0.011 032 |
| $n_h - n_g$         | 0.009 365 |
| $n_i - n_g$         | 0.025 786 |
| $n_{C'} - n_t$      | 0.015 630 |
| $n_e - n_{C'}$      | 0.009 546 |
| $n_{F'} - n_e$      | 0.010 210 |
| $n_i - n_{F'}$      | 0.035 675 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.753 3 |
| $\theta_{C,A'}$              | 0.330 9 |
| $\theta_{d,C}$               | 0.298 1 |
| $\theta_{e,C}$               | 0.535 8 |
| $\theta_{g,d}$               | 1.266 8 |
| $\theta_{g,F}$               | 0.564 8 |
| $\theta_{h,g}$               | 0.479 5 |
| $\theta_{i,g}$               | 1.320 3 |
| $\theta'_{C,t}$              | 0.791 2 |
| $\theta'_{e,C'}$             | 0.483 2 |
| $\theta'_{F,e}$              | 0.516 8 |
| $\theta'_{i,F'}$             | 1.805 8 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.006 1  |
| $\Delta\theta_{C,A'}$ | 0.003 2  |
| $\Delta\theta_{g,d}$  | -0.009 1 |
| $\Delta\theta_{g,F}$  | -0.007 5 |
| $\Delta\theta_{i,g}$  | -0.046 8 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 395  | $\lambda_5$      | 320 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 356  | $\lambda_{0.05}$ | 319 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.65 | 0.68             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    | 0.06             |
| 330                    | 0.28             |
| 340                    | 0.55             |
| 350                    | 0.73             |
| 360                    | 0.84             |
| 370                    | 0.90             |
| 380                    | 0.936            |
| 390                    | 0.957            |
| 400                    | 0.970            |
| 420                    | 0.982            |
| 440                    | 0.988            |
| 460                    | 0.991            |
| 480                    | 0.994            |
| 500                    | 0.996            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.988            |
| 2 000                  | 0.968            |
| 2 200                  | 0.920            |
| 2 400                  | 0.74             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 639   |
| Annealing Point AP (°C)                                          | 667   |
| Transformation Temperature Tg (°C)                               | 685   |
| Yield Point At (°C)                                              | 714   |
| Softening Point SP (°C)                                          | 738   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 66    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 79    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.864 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 52                                             |
| -90 ~ -80                               | 54                                             |
| -80 ~ -70                               | 55                                             |
| -70 ~ -60                               | 56                                             |
| -60 ~ -50                               | 57                                             |
| -50 ~ -40                               | 59                                             |
| -40 ~ -30                               | 60                                             |
| -30 ~ -20                               | 61                                             |
| -20 ~ -10                               | 62                                             |
| -10 ~ 0                                 | 63                                             |
| 0 ~ 10                                  | 64                                             |
| 10 ~ 20                                 | 65                                             |
| 20 ~ 30                                 | 66                                             |
| 30 ~ 40                                 | 67                                             |
| 40 ~ 50                                 | 68                                             |
| 50 ~ 60                                 | 69                                             |
| 60 ~ 70                                 | 70                                             |
| 70 ~ 80                                 | 71                                             |
| 80 ~ 90                                 | 72                                             |
| 90 ~ 100                                | 73                                             |
| 100 ~ 110                               | 74                                             |
| 110 ~ 120                               | 74                                             |
| 120 ~ 130                               | 75                                             |
| 130 ~ 140                               | 76                                             |
| 140 ~ 150                               | 77                                             |
| 150 ~ 160                               | 77                                             |
| 160 ~ 170                               | 78                                             |
| 170 ~ 180                               | 79                                             |
| 180 ~ 190                               | 79                                             |
| 190 ~ 200                               | 80                                             |
| 200 ~ 210                               | 80                                             |
| 210 ~ 220                               | 81                                             |
| 220 ~ 230                               | 81                                             |
| 230 ~ 240                               | 82                                             |
| 240 ~ 250                               | 82                                             |
| 250 ~ 260                               | 83                                             |
| 260 ~ 270                               | 83                                             |
| 270 ~ 280                               | 83                                             |
| 280 ~ 290                               | 84                                             |
| 290 ~ 300                               | 84                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.31 |
| Specific Gravity $d$                                     | 4.58 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.6                                                             | 2.7 | 3.1 | 3.2 | 3.4 | 3.6 | 3.8 | 4.2 | 4.3 | 4.9 | 5.4 | 6.6 |
| -60 ~ -40                                    | 2.5                                                             | 2.7 | 3.1 | 3.2 | 3.2 | 3.5 | 3.8 | 4.2 | 4.3 | 4.8 | 5.5 | 6.7 |
| -40 ~ -20                                    | 2.4                                                             | 2.7 | 3.2 | 3.3 | 3.3 | 3.6 | 3.8 | 4.3 | 4.4 | 5.0 | 5.7 | 6.9 |
| -20 ~ 0                                      | 2.6                                                             | 2.8 | 3.2 | 3.4 | 3.4 | 3.7 | 3.9 | 4.5 | 4.6 | 5.2 | 5.9 | 7.3 |
| 0 ~ 20                                       | 2.7                                                             | 2.9 | 3.4 | 3.5 | 3.6 | 3.8 | 4.1 | 4.7 | 4.8 | 5.4 | 6.1 | 7.5 |
| 20 ~ 40                                      | 2.7                                                             | 3.0 | 3.5 | 3.7 | 3.7 | 4.0 | 4.3 | 4.8 | 4.9 | 5.6 | 6.4 | 7.9 |
| 40 ~ 60                                      | 2.9                                                             | 3.2 | 3.7 | 3.8 | 3.9 | 4.2 | 4.5 | 5.0 | 5.1 | 6.0 | 6.7 | 8.2 |
| 60 ~ 80                                      | 3.0                                                             | 3.2 | 3.8 | 3.9 | 4.0 | 4.3 | 4.7 | 5.3 | 5.4 | 6.1 | 6.9 | 8.5 |
| 80 ~ 100                                     | 3.1                                                             | 3.4 | 3.9 | 4.1 | 4.2 | 4.5 | 4.8 | 5.4 | 5.5 | 6.4 | 7.2 | 8.8 |
| 100 ~ 120                                    | 3.1                                                             | 3.4 | 4.0 | 4.2 | 4.3 | 4.6 | 4.9 | 5.6 | 5.7 | 6.5 | 7.3 | 9.1 |
| 120 ~ 140                                    | 3.2                                                             | 3.5 | 4.1 | 4.3 | 4.3 | 4.7 | 5.0 | 5.7 | 5.8 | 6.6 | 7.5 | 9.4 |
| 140 ~ 160                                    | 3.2                                                             | 3.5 | 4.1 | 4.3 | 4.4 | 4.7 | 5.0 | 5.8 | 5.9 | 6.7 | 7.8 | 9.6 |
| 160 ~ 180                                    | 3.1                                                             | 3.4 | 4.1 | 4.4 | 4.5 | 4.8 | 5.2 | 5.9 | 6.0 | 6.9 | 7.8 | 9.7 |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.883 00<br>1.882 997 | Abbe Number $\nu_d$ | 40.76 | Dispersion $n_F - n_C$       | 0.021 661 |
| Refractive Index $n_e$ | 1.888 146             | Abbe Number $\nu_e$ | 40.52 | Dispersion $n_{F'} - n_{C'}$ | 0.021 919 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.835 90 |
| $n_{1970}$         | 1.970 09  | 1.842 64 |
| $n_{1530}$         | 1.529 58  | 1.850 23 |
| $n_{1129}$         | 1.128 64  | 1.857 76 |
| $n_t$              | 1.013 98  | 1.860 54 |
| $n_s$              | 0.852 11  | 1.865 72 |
| $n_{A'}$           | 0.768 19  | 1.869 46 |
| $n_F$              | 0.706 52  | 1.872 98 |
| $n_C$              | 0.656 27  | 1.876 56 |
| $n_{C'}$           | 0.643 85  | 1.877 57 |
| $n_{He-Ne}$        | 0.632 8   | 1.878 52 |
| $n_D$              | 0.589 29  | 1.882 81 |
| $n_d$              | 0.587 56  | 1.883 00 |
| $n_e$              | 0.546 07  | 1.888 15 |
| $n_F$              | 0.486 13  | 1.898 22 |
| $n_{F'}$           | 0.479 99  | 1.899 49 |
| $n_{He-Cd}$        | 0.441 57  | 1.908 85 |
| $n_g$              | 0.435 835 | 1.910 50 |
| $n_h$              | 0.404 656 | 1.920 92 |
| $n_i$              | 0.365 015 | 1.939 17 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.787 649 64E+00 |
| $A_2$                           | 6.526 356 00E-01 |
| $A_3$                           | 1.799 145 64E+00 |
| $B_1$                           | 8.473 785 36E-03 |
| $B_2$                           | 3.131 264 08E-02 |
| $B_3$                           | 1.327 880 01E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 2.2 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 126.8 |
| Rigidity Modulus G (GPa) | 48.7  |
| Poisson's Ratio $\sigma$ | 0.301 |
| Knoop Hardness Hk[Class] | 720 7 |
| Abrasion Aa              | 62    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.016 022 |
| $n_C - n_{A'}$      | 0.007 103 |
| $n_d - n_C$         | 0.006 437 |
| $n_e - n_C$         | 0.011 586 |
| $n_g - n_d$         | 0.027 500 |
| $n_g - n_F$         | 0.012 276 |
| $n_h - n_g$         | 0.010 422 |
| $n_i - n_g$         | 0.028 677 |
| $n_{C'} - n_t$      | 0.017 035 |
| $n_e - n_{C'}$      | 0.010 573 |
| $n_{F'} - n_e$      | 0.011 346 |
| $n_i - n_{F'}$      | 0.039 682 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.739 7 |
| $\theta_{C,A'}$              | 0.327 9 |
| $\theta_{d,C}$               | 0.297 2 |
| $\theta_{e,C}$               | 0.534 9 |
| $\theta_{g,d}$               | 1.269 6 |
| $\theta_{g,F}$               | 0.566 7 |
| $\theta_{h,g}$               | 0.481 1 |
| $\theta_{i,g}$               | 1.323 9 |
| $\theta'_{C,t}$              | 0.777 2 |
| $\theta'_{e,C'}$             | 0.482 4 |
| $\theta'_{F',e}$             | 0.517 6 |
| $\theta'_{i,F'}$             | 1.810 4 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.001 8  |
| $\Delta\theta_{C,A'}$ | 0.002 6  |
| $\Delta\theta_{g,d}$  | -0.010 5 |
| $\Delta\theta_{g,F}$  | -0.008 8 |
| $\Delta\theta_{i,g}$  | -0.059 8 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 315 |
| $\lambda_{70}$        | 375  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 374  | $\lambda_{0.05}$ | 320 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.69 | 1.75             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    | 0.05             |
| 330                    | 0.17             |
| 340                    | 0.34             |
| 350                    | 0.51             |
| 360                    | 0.66             |
| 370                    | 0.77             |
| 380                    | 0.84             |
| 390                    | 0.89             |
| 400                    | 0.924            |
| 420                    | 0.951            |
| 440                    | 0.965            |
| 460                    | 0.974            |
| 480                    | 0.982            |
| 500                    | 0.988            |
| 550                    | 0.995            |
| 600                    | 0.995            |
| 650                    | 0.995            |
| 700                    | 0.995            |
| 800                    | 0.995            |
| 900                    | 0.995            |
| 1 000                  | 0.995            |
| 1 200                  | 0.996            |
| 1 400                  | 0.996            |
| 1 600                  | 0.996            |
| 1 800                  | 0.992            |
| 2 000                  | 0.980            |
| 2 200                  | 0.956            |
| 2 400                  | 0.84             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 666   |
| Annealing Point AP (°C)                                          | 714   |
| Transformation Temperature Tg (°C)                               | 737   |
| Yield Point At (°C)                                              | 767   |
| Softening Point SP (°C)                                          | 803   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 67    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 80    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.827 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 54                                             |
| -90 ~ -80                               | 56                                             |
| -80 ~ -70                               | 57                                             |
| -70 ~ -60                               | 58                                             |
| -60 ~ -50                               | 59                                             |
| -50 ~ -40                               | 60                                             |
| -40 ~ -30                               | 61                                             |
| -30 ~ -20                               | 63                                             |
| -20 ~ -10                               | 64                                             |
| -10 ~ 0                                 | 65                                             |
| 0 ~ 10                                  | 66                                             |
| 10 ~ 20                                 | 67                                             |
| 20 ~ 30                                 | 68                                             |
| 30 ~ 40                                 | 69                                             |
| 40 ~ 50                                 | 69                                             |
| 50 ~ 60                                 | 70                                             |
| 60 ~ 70                                 | 71                                             |
| 70 ~ 80                                 | 72                                             |
| 80 ~ 90                                 | 73                                             |
| 90 ~ 100                                | 74                                             |
| 100 ~ 110                               | 74                                             |
| 110 ~ 120                               | 75                                             |
| 120 ~ 130                               | 76                                             |
| 130 ~ 140                               | 77                                             |
| 140 ~ 150                               | 77                                             |
| 150 ~ 160                               | 78                                             |
| 160 ~ 170                               | 79                                             |
| 170 ~ 180                               | 79                                             |
| 180 ~ 190                               | 80                                             |
| 190 ~ 200                               | 80                                             |
| 200 ~ 210                               | 81                                             |
| 210 ~ 220                               | 81                                             |
| 220 ~ 230                               | 82                                             |
| 230 ~ 240                               | 82                                             |
| 240 ~ 250                               | 83                                             |
| 250 ~ 260                               | 83                                             |
| 260 ~ 270                               | 84                                             |
| 270 ~ 280                               | 84                                             |
| 280 ~ 290                               | 84                                             |
| 290 ~ 300                               | 85                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.30 |
| Specific Gravity $d$                                     | 5.52 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 2.4                                                             | 2.7 | 3.2 | 3.4 | 3.4 | 3.8 | 4.0 | 4.6 | 4.7 | 5.3 | 6.1 | 7.5  |
| -60 ~ -40                                    | 2.3                                                             | 2.6 | 3.1 | 3.3 | 3.4 | 3.6 | 4.0 | 4.6 | 4.6 | 5.3 | 6.1 | 7.5  |
| -40 ~ -20                                    | 2.3                                                             | 2.6 | 3.1 | 3.3 | 3.4 | 3.7 | 4.0 | 4.6 | 4.7 | 5.4 | 6.2 | 7.7  |
| -20 ~ 0                                      | 2.4                                                             | 2.6 | 3.3 | 3.5 | 3.5 | 3.8 | 4.1 | 4.7 | 4.8 | 5.5 | 6.4 | 7.9  |
| 0 ~ 20                                       | 2.5                                                             | 2.7 | 3.4 | 3.6 | 3.6 | 4.0 | 4.3 | 4.9 | 5.0 | 5.7 | 6.6 | 8.1  |
| 20 ~ 40                                      | 2.6                                                             | 2.9 | 3.5 | 3.7 | 3.7 | 4.1 | 4.5 | 5.1 | 5.2 | 6.0 | 6.8 | 8.4  |
| 40 ~ 60                                      | 2.7                                                             | 3.0 | 3.6 | 3.8 | 3.9 | 4.3 | 4.5 | 5.3 | 5.4 | 6.2 | 7.0 | 8.7  |
| 60 ~ 80                                      | 2.8                                                             | 3.2 | 3.9 | 4.1 | 4.1 | 4.5 | 4.8 | 5.5 | 5.6 | 6.4 | 7.3 | 9.0  |
| 80 ~ 100                                     | 3.0                                                             | 3.3 | 3.9 | 4.2 | 4.2 | 4.7 | 5.0 | 5.7 | 5.8 | 6.7 | 7.5 | 9.2  |
| 100 ~ 120                                    | 3.1                                                             | 3.4 | 4.1 | 4.3 | 4.4 | 4.7 | 5.1 | 5.8 | 5.9 | 6.9 | 7.8 | 9.5  |
| 120 ~ 140                                    | 3.2                                                             | 3.5 | 4.2 | 4.4 | 4.5 | 4.9 | 5.2 | 6.0 | 6.1 | 7.1 | 8.0 | 9.8  |
| 140 ~ 160                                    | 3.2                                                             | 3.6 | 4.3 | 4.5 | 4.6 | 4.9 | 5.3 | 6.2 | 6.3 | 7.2 | 8.2 | 10.0 |
| 160 ~ 180                                    | 3.3                                                             | 3.7 | 4.4 | 4.7 | 4.7 | 5.1 | 5.5 | 6.3 | 6.4 | 7.3 | 8.3 | 10.2 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.816 00<br>1.816 000 | Abbe Number $\nu_d$ | 46.62 | Dispersion $n_F - n_C$       | 0.017 503 |
| Refractive Index $n_e$ | 1.820 167             | Abbe Number $\nu_e$ | 46.37 | Dispersion $n_{F'} - n_{C'}$ | 0.017 688 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.773 45 |
| $n_{1970}$         | 1.970 09  | 1.780 33 |
| $n_{1530}$         | 1.529 58  | 1.787 84 |
| $n_{1129}$         | 1.128 64  | 1.794 83 |
| $n_t$              | 1.013 98  | 1.797 29 |
| $n_s$              | 0.852 11  | 1.801 74 |
| $n_{A'}$           | 0.768 19  | 1.804 88 |
| $n_F$              | 0.706 52  | 1.807 80 |
| $n_C$              | 0.656 27  | 1.810 75 |
| $n_{C'}$           | 0.643 85  | 1.811 58 |
| $n_{He-Ne}$        | 0.632 8   | 1.812 36 |
| $n_D$              | 0.589 29  | 1.815 85 |
| $n_d$              | 0.587 56  | 1.816 00 |
| $n_e$              | 0.546 07  | 1.820 17 |
| $n_F$              | 0.486 13  | 1.828 25 |
| $n_{F'}$           | 0.479 99  | 1.829 27 |
| $n_{He-Cd}$        | 0.441 57  | 1.836 70 |
| $n_g$              | 0.435 835 | 1.838 00 |
| $n_h$              | 0.404 656 | 1.846 19 |
| $n_i$              | 0.365 015 | 1.860 34 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.513 729 67E+00 |
| $A_2$                           | 7.024 623 43E-01 |
| $A_3$                           | 1.336 009 82E+00 |
| $B_1$                           | 7.052 469 01E-03 |
| $B_2$                           | 2.494 886 89E-02 |
| $B_3$                           | 1.000 859 08E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 2   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 3.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 125.0 |
| Rigidity Modulus G (GPa) | 48.2  |
| Poisson's Ratio $\sigma$ | 0.298 |
| Knoop Hardness Hk[Class] | 740 7 |
| Abrasion Aa              | 50    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.013 459 |
| $n_C - n_{A'}$      | 0.005 870 |
| $n_d - n_C$         | 0.005 251 |
| $n_e - n_C$         | 0.009 418 |
| $n_g - n_d$         | 0.021 997 |
| $n_g - n_F$         | 0.009 745 |
| $n_h - n_g$         | 0.008 188 |
| $n_i - n_g$         | 0.022 341 |
| $n_{C'} - n_t$      | 0.014 289 |
| $n_e - n_{C'}$      | 0.008 588 |
| $n_{F'} - n_e$      | 0.009 100 |
| $n_i - n_{F'}$      | 0.031 071 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.769 0 |
| $\theta_{C,A'}$              | 0.335 4 |
| $\theta_{d,C}$               | 0.300 0 |
| $\theta_{e,C}$               | 0.538 1 |
| $\theta_{g,d}$               | 1.256 8 |
| $\theta_{g,F}$               | 0.556 8 |
| $\theta_{h,g}$               | 0.467 8 |
| $\theta_{i,g}$               | 1.276 4 |
| $\theta'_{C,t}$              | 0.807 8 |
| $\theta'_{e,C'}$             | 0.485 5 |
| $\theta'_{F,e}$              | 0.514 5 |
| $\theta'_{i,F'}$             | 1.756 6 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.003 6  |
| $\Delta\theta_{C,A'}$ | 0.003 0  |
| $\Delta\theta_{g,d}$  | -0.011 1 |
| $\Delta\theta_{g,F}$  | -0.009 2 |
| $\Delta\theta_{i,g}$  | -0.058 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 390  | $\lambda_5$      | 290 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 359  | $\lambda_{0.05}$ | 298 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.94 | 0.93             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    | 0.02             |
| 300                    | 0.06             |
| 310                    | 0.09             |
| 320                    | 0.28             |
| 330                    | 0.43             |
| 340                    | 0.58             |
| 350                    | 0.71             |
| 360                    | 0.81             |
| 370                    | 0.88             |
| 380                    | 0.921            |
| 390                    | 0.943            |
| 400                    | 0.958            |
| 420                    | 0.973            |
| 440                    | 0.979            |
| 460                    | 0.984            |
| 480                    | 0.989            |
| 500                    | 0.994            |
| 550                    | 0.997            |
| 600                    | 0.996            |
| 650                    | 0.996            |
| 700                    | 0.996            |
| 800                    | 0.996            |
| 900                    | 0.995            |
| 1 000                  | 0.995            |
| 1 200                  | 0.995            |
| 1 400                  | 0.995            |
| 1 600                  | 0.994            |
| 1 800                  | 0.989            |
| 2 000                  | 0.973            |
| 2 200                  | 0.938            |
| 2 400                  | 0.76             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 644   |
| Annealing Point AP (°C)                                          | 690   |
| Transformation Temperature Tg (°C)                               | 715   |
| Yield Point At (°C)                                              | 750   |
| Softening Point SP (°C)                                          | 773   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 64    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 77    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.816 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 51                                             |
| -90 ~ -80                               | 53                                             |
| -80 ~ -70                               | 54                                             |
| -70 ~ -60                               | 55                                             |
| -60 ~ -50                               | 56                                             |
| -50 ~ -40                               | 57                                             |
| -40 ~ -30                               | 58                                             |
| -30 ~ -20                               | 59                                             |
| -20 ~ -10                               | 60                                             |
| -10 ~ 0                                 | 61                                             |
| 0 ~ 10                                  | 62                                             |
| 10 ~ 20                                 | 63                                             |
| 20 ~ 30                                 | 64                                             |
| 30 ~ 40                                 | 65                                             |
| 40 ~ 50                                 | 66                                             |
| 50 ~ 60                                 | 67                                             |
| 60 ~ 70                                 | 68                                             |
| 70 ~ 80                                 | 69                                             |
| 80 ~ 90                                 | 70                                             |
| 90 ~ 100                                | 71                                             |
| 100 ~ 110                               | 71                                             |
| 110 ~ 120                               | 72                                             |
| 120 ~ 130                               | 73                                             |
| 130 ~ 140                               | 74                                             |
| 140 ~ 150                               | 74                                             |
| 150 ~ 160                               | 75                                             |
| 160 ~ 170                               | 76                                             |
| 170 ~ 180                               | 76                                             |
| 180 ~ 190                               | 77                                             |
| 190 ~ 200                               | 77                                             |
| 200 ~ 210                               | 78                                             |
| 210 ~ 220                               | 78                                             |
| 220 ~ 230                               | 79                                             |
| 230 ~ 240                               | 79                                             |
| 240 ~ 250                               | 80                                             |
| 250 ~ 260                               | 80                                             |
| 260 ~ 270                               | 81                                             |
| 270 ~ 280                               | 81                                             |
| 280 ~ 290                               | 82                                             |
| 290 ~ 300                               | 82                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.37 |
| Specific Gravity $d$                                     | 5.07 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 3.2                                                             | 3.4 | 3.8 | 4.0 | 4.0 | 4.2 | 4.4 | 4.9 | 5.0 | 5.4 | 6.0 | 6.9 |
| -60 ~ -40                                    | 3.0                                                             | 3.3 | 3.7 | 3.8 | 3.9 | 4.1 | 4.3 | 4.8 | 4.9 | 5.4 | 5.9 | 6.9 |
| -40 ~ -20                                    | 3.0                                                             | 3.2 | 3.6 | 3.8 | 3.9 | 4.1 | 4.3 | 4.8 | 4.9 | 5.4 | 6.0 | 7.0 |
| -20 ~ 0                                      | 2.9                                                             | 3.3 | 3.7 | 3.9 | 3.9 | 4.2 | 4.4 | 4.9 | 4.9 | 5.6 | 6.1 | 7.1 |
| 0 ~ 20                                       | 3.1                                                             | 3.3 | 3.8 | 4.0 | 4.0 | 4.3 | 4.5 | 5.0 | 5.1 | 5.7 | 6.3 | 7.4 |
| 20 ~ 40                                      | 3.1                                                             | 3.4 | 4.0 | 4.1 | 4.2 | 4.4 | 4.7 | 5.2 | 5.3 | 5.9 | 6.5 | 7.7 |
| 40 ~ 60                                      | 3.3                                                             | 3.6 | 4.1 | 4.3 | 4.3 | 4.6 | 4.9 | 5.4 | 5.5 | 6.1 | 6.8 | 8.0 |
| 60 ~ 80                                      | 3.4                                                             | 3.7 | 4.2 | 4.4 | 4.4 | 4.7 | 5.0 | 5.6 | 5.7 | 6.4 | 7.0 | 8.2 |
| 80 ~ 100                                     | 3.6                                                             | 3.9 | 4.4 | 4.6 | 4.6 | 4.9 | 5.2 | 5.8 | 5.9 | 6.5 | 7.2 | 8.5 |
| 100 ~ 120                                    | 3.7                                                             | 4.0 | 4.6 | 4.8 | 4.8 | 5.1 | 5.4 | 6.0 | 6.1 | 6.8 | 7.4 | 8.7 |
| 120 ~ 140                                    | 3.8                                                             | 4.1 | 4.7 | 4.9 | 5.0 | 5.3 | 5.6 | 6.2 | 6.3 | 7.0 | 7.7 | 9.0 |
| 140 ~ 160                                    | 3.9                                                             | 4.2 | 4.9 | 5.0 | 5.1 | 5.4 | 5.7 | 6.4 | 6.4 | 7.2 | 7.9 | 9.4 |
| 160 ~ 180                                    | 4.0                                                             | 4.3 | 4.9 | 5.2 | 5.2 | 5.5 | 5.9 | 6.6 | 6.7 | 7.4 | 8.2 | 9.6 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.834 00<br>1.834 000 | Abbe Number $\nu_d$ | 37.16 | Dispersion $n_F - n_C$       | 0.022 443 |
| Refractive Index $n_e$ | 1.839 323             | Abbe Number $\nu_e$ | 36.92 | Dispersion $n_{F'} - n_{C'}$ | 0.022 736 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.784 73 |
| $n_{1970}$         | 1.970 09  | 1.792 05 |
| $n_{1530}$         | 1.529 58  | 1.800 18 |
| $n_{1129}$         | 1.128 64  | 1.808 07 |
| $n_t$              | 1.013 98  | 1.810 94 |
| $n_s$              | 0.852 11  | 1.816 27 |
| $n_{A'}$           | 0.768 19  | 1.820 09 |
| $n_F$              | 0.706 52  | 1.823 70 |
| $n_C$              | 0.656 27  | 1.827 38 |
| $n_{C'}$           | 0.643 85  | 1.828 42 |
| $n_{He-Ne}$        | 0.632 8   | 1.829 39 |
| $n_D$              | 0.589 29  | 1.833 80 |
| $n_d$              | 0.587 56  | 1.834 00 |
| $n_e$              | 0.546 07  | 1.839 32 |
| $n_F$              | 0.486 13  | 1.849 82 |
| $n_{F'}$           | 0.479 99  | 1.851 15 |
| $n_{He-Cd}$        | 0.441 57  | 1.861 03 |
| $n_g$              | 0.435 835 | 1.862 78 |
| $n_h$              | 0.404 656 | 1.873 96 |
| $n_i$              | 0.365 015 | 1.894 03 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.952 434 69E+00 |
| $A_2$                           | 3.071 002 10E-01 |
| $A_3$                           | 1.565 780 94E+00 |
| $B_1$                           | 1.064 424 37E-02 |
| $B_2$                           | 4.567 353 02E-02 |
| $B_3$                           | 1.102 814 10E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 4,2 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 124.8 |
| Rigidity Modulus G (GPa) | 48.1  |
| Poisson's Ratio $\sigma$ | 0.296 |
| Knoop Hardness Hk[Class] | 660 7 |
| Abrasion Aa              | 79    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.016 437 |
| $n_C - n_{A'}$      | 0.007 283 |
| $n_d - n_C$         | 0.006 624 |
| $n_e - n_C$         | 0.011 947 |
| $n_g - n_d$         | 0.028 781 |
| $n_g - n_F$         | 0.012 962 |
| $n_h - n_g$         | 0.011 183 |
| $n_i - n_g$         | 0.031 249 |
| $n_{C'} - n_t$      | 0.017 477 |
| $n_e - n_{C'}$      | 0.010 907 |
| $n_{F'} - n_e$      | 0.011 829 |
| $n_i - n_{F'}$      | 0.042 878 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.732 4 |
| $\theta_{C,A'}$              | 0.324 5 |
| $\theta_{d,C}$               | 0.295 1 |
| $\theta_{e,C}$               | 0.532 3 |
| $\theta_{g,d}$               | 1.282 4 |
| $\theta_{g,F}$               | 0.577 6 |
| $\theta_{h,g}$               | 0.498 3 |
| $\theta_{i,g}$               | 1.392 4 |
| $\theta'_{C,t}$              | 0.768 7 |
| $\theta'_{e,C'}$             | 0.479 7 |
| $\theta'_{F',e}$             | 0.520 3 |
| $\theta'_{i,F'}$             | 1.885 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.011 4  |
| $\Delta\theta_{C,A'}$ | 0.003 6  |
| $\Delta\theta_{g,d}$  | -0.005 1 |
| $\Delta\theta_{g,F}$  | -0.003 7 |
| $\Delta\theta_{i,g}$  | -0.021 5 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 420  | $\lambda_5$      | 340 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 377  | $\lambda_{0.05}$ | 341 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.57 | 1.66             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.03             |
| 350                    | 0.27             |
| 360                    | 0.54             |
| 370                    | 0.72             |
| 380                    | 0.83             |
| 390                    | 0.88             |
| 400                    | 0.924            |
| 420                    | 0.957            |
| 440                    | 0.972            |
| 460                    | 0.980            |
| 480                    | 0.986            |
| 500                    | 0.990            |
| 550                    | 0.996            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.996            |
| 1 400                  | 0.993            |
| 1 600                  | 0.992            |
| 1 800                  | 0.984            |
| 2 000                  | 0.964            |
| 2 200                  | 0.906            |
| 2 400                  | 0.72             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 608   |
| Yield Point At (°C)                                              | 644   |
| Softening Point SP (°C)                                          | 676   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 58    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 73    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.872 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 45                                             |
| -90 ~ -80                               | 47                                             |
| -80 ~ -70                               | 48                                             |
| -70 ~ -60                               | 49                                             |
| -60 ~ -50                               | 50                                             |
| -50 ~ -40                               | 51                                             |
| -40 ~ -30                               | 52                                             |
| -30 ~ -20                               | 53                                             |
| -20 ~ -10                               | 54                                             |
| -10 ~ 0                                 | 55                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 60                                             |
| 40 ~ 50                                 | 60                                             |
| 50 ~ 60                                 | 61                                             |
| 60 ~ 70                                 | 62                                             |
| 70 ~ 80                                 | 63                                             |
| 80 ~ 90                                 | 64                                             |
| 90 ~ 100                                | 65                                             |
| 100 ~ 110                               | 66                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 68                                             |
| 140 ~ 150                               | 69                                             |
| 150 ~ 160                               | 70                                             |
| 160 ~ 170                               | 71                                             |
| 170 ~ 180                               | 72                                             |
| 180 ~ 190                               | 72                                             |
| 190 ~ 200                               | 73                                             |
| 200 ~ 210                               | 74                                             |
| 210 ~ 220                               | 74                                             |
| 220 ~ 230                               | 75                                             |
| 230 ~ 240                               | 76                                             |
| 240 ~ 250                               | 76                                             |
| 250 ~ 260                               | 77                                             |
| 260 ~ 270                               | 78                                             |
| 270 ~ 280                               | 78                                             |
| 280 ~ 290                               | 79                                             |
| 290 ~ 300                               | 79                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.15 |
| Specific Gravity $d$                                      | 4.43 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |      |      |      |      |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | 4.7                                                             | 5.0 | 5.5 | 5.7 | 5.8 | 6.2 | 6.5 | 7.1  | 7.2  | 8.1  | 8.9  | 10.8 |
| -60 ~ -40                                    | 4.7                                                             | 4.9 | 5.5 | 5.7 | 5.7 | 6.2 | 6.5 | 7.2  | 7.2  | 8.1  | 9.1  | 10.9 |
| -40 ~ -20                                    | 4.7                                                             | 4.9 | 5.6 | 5.8 | 5.9 | 6.2 | 6.6 | 7.3  | 7.4  | 8.3  | 9.3  | 11.2 |
| -20 ~ 0                                      | 4.8                                                             | 5.1 | 5.8 | 6.0 | 6.0 | 6.4 | 6.7 | 7.6  | 7.7  | 8.6  | 9.6  | 11.7 |
| 0 ~ 20                                       | 4.9                                                             | 5.3 | 5.9 | 6.2 | 6.2 | 6.6 | 6.9 | 7.8  | 7.9  | 8.9  | 9.9  | 12.0 |
| 20 ~ 40                                      | 5.0                                                             | 5.5 | 6.2 | 6.4 | 6.5 | 6.9 | 7.2 | 8.0  | 8.1  | 9.2  | 10.3 | 12.5 |
| 40 ~ 60                                      | 5.3                                                             | 5.7 | 6.4 | 6.6 | 6.7 | 7.1 | 7.5 | 8.3  | 8.4  | 9.6  | 10.7 | 13.0 |
| 60 ~ 80                                      | 5.5                                                             | 5.8 | 6.6 | 6.8 | 6.9 | 7.3 | 7.8 | 8.7  | 8.8  | 9.9  | 11.0 | 13.4 |
| 80 ~ 100                                     | 5.6                                                             | 6.0 | 6.8 | 7.1 | 7.1 | 7.6 | 8.0 | 8.9  | 9.0  | 10.2 | 11.4 | 13.9 |
| 100 ~ 120                                    | 5.8                                                             | 6.2 | 7.0 | 7.3 | 7.4 | 7.8 | 8.3 | 9.2  | 9.3  | 10.5 | 11.7 | 14.4 |
| 120 ~ 140                                    | 6.0                                                             | 6.4 | 7.2 | 7.5 | 7.6 | 8.0 | 8.5 | 9.4  | 9.6  | 10.8 | 12.1 | 14.8 |
| 140 ~ 160                                    | 6.1                                                             | 6.5 | 7.4 | 7.6 | 7.7 | 8.2 | 8.7 | 9.7  | 9.8  | 11.0 | 12.5 | 15.2 |
| 160 ~ 180                                    | 6.2                                                             | 6.6 | 7.5 | 7.8 | 8.0 | 8.4 | 8.9 | 10.0 | 10.1 | 11.4 | 12.7 | 15.6 |

## S-LAH60MQ

Code(d) 834372  
Code(e) 839369

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.834 00<br>1.834 000 | Abbe Number $\nu_d$ | 37.17 | Dispersion $n_F - n_C$       | 0.022 437 |
| Refractive Index $n_e$ | 1.839 321             | Abbe Number $\nu_e$ | 36.92 | Dispersion $n_{F'} - n_{C'}$ | 0.022 735 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.788 10 |
| $n_{1970}$         | 1.970 09  | 1.794 30 |
| $n_{1530}$         | 1.529 58  | 1.801 35 |
| $n_{1129}$         | 1.128 64  | 1.808 54 |
| $n_t$              | 1.013 98  | 1.811 25 |
| $n_s$              | 0.852 11  | 1.816 41 |
| $n_{A'}$           | 0.768 19  | 1.820 17 |
| $n_F$              | 0.706 52  | 1.823 74 |
| $n_C$              | 0.656 27  | 1.827 39 |
| $n_{C'}$           | 0.643 85  | 1.828 43 |
| $n_{He-Ne}$        | 0.632 8   | 1.829 40 |
| $n_D$              | 0.589 29  | 1.833 80 |
| $n_d$              | 0.587 56  | 1.834 00 |
| $n_e$              | 0.546 07  | 1.839 32 |
| $n_F$              | 0.486 13  | 1.849 83 |
| $n_{F'}$           | 0.479 99  | 1.851 16 |
| $n_{He-Cd}$        | 0.441 57  | 1.861 06 |
| $n_g$              | 0.435 835 | 1.862 81 |
| $n_h$              | 0.404 656 | 1.874 01 |
| $n_i$              | 0.365 015 | 1.894 07 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.955 390 63E+00 |
| $A_2$                           | 3.025 502 19E-01 |
| $A_3$                           | 1.343 113 90E+00 |
| $B_1$                           | 1.091 113 65E-02 |
| $B_2$                           | 4.546 667 00E-02 |
| $B_3$                           | 1.135 808 50E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 1.2  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 95.3  |
| Rigidity Modulus G (GPa) | 36.6  |
| Poisson's Ratio $\sigma$ | 0.302 |
| Knoop Hardness Hk[Class] | 560 6 |
| Abrasion Aa              | 160   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.016 137 |
| $n_C - n_{A'}$      | 0.007 222 |
| $n_d - n_C$         | 0.006 608 |
| $n_e - n_C$         | 0.011 929 |
| $n_g - n_d$         | 0.028 810 |
| $n_g - n_F$         | 0.012 981 |
| $n_h - n_g$         | 0.011 196 |
| $n_i - n_g$         | 0.031 262 |
| $n_{C'} - n_t$      | 0.017 174 |
| $n_e - n_{C'}$      | 0.010 892 |
| $n_{F'} - n_e$      | 0.011 843 |
| $n_i - n_{F'}$      | 0.042 908 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.719 2 |
| $\theta_{C,A'}$              | 0.321 9 |
| $\theta_{d,C}$               | 0.294 5 |
| $\theta_{e,C}$               | 0.531 7 |
| $\theta_{g,d}$               | 1.284 0 |
| $\theta_{g,F}$               | 0.578 6 |
| $\theta_{h,g}$               | 0.499 0 |
| $\theta_{i,g}$               | 1.393 3 |
| $\theta'_{C,t}$              | 0.755 4 |
| $\theta'_{e,C'}$             | 0.479 1 |
| $\theta'_{F',e}$             | 0.520 9 |
| $\theta'_{i,F'}$             | 1.887 3 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.001 9 |
| $\Delta\theta_{C,A'}$ | 0.001 0  |
| $\Delta\theta_{g,d}$  | -0.003 5 |
| $\Delta\theta_{g,F}$  | -0.002 7 |
| $\Delta\theta_{i,g}$  | -0.020 5 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 425  | $\lambda_5$      | 340 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 377  | $\lambda_{0.05}$ | 336 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.58 | 1.64             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.08             |
| 350                    | 0.31             |
| 360                    | 0.56             |
| 370                    | 0.73             |
| 380                    | 0.83             |
| 390                    | 0.89             |
| 400                    | 0.927            |
| 420                    | 0.957            |
| 440                    | 0.968            |
| 460                    | 0.976            |
| 480                    | 0.983            |
| 500                    | 0.989            |
| 550                    | 0.995            |
| 600                    | 0.995            |
| 650                    | 0.995            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.995            |
| 1 800                  | 0.986            |
| 2 000                  | 0.968            |
| 2 200                  | 0.927            |
| 2 400                  | 0.80             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 609   |
| Annealing Point AP (°C)                                          | 635   |
| Transformation Temperature Tg (°C)                               | 659   |
| Yield Point At (°C)                                              | 688   |
| Softening Point SP (°C)                                          | 721   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 86    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 100   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.701 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 72                                             |
| -90 ~ -80                               | 73                                             |
| -80 ~ -70                               | 74                                             |
| -70 ~ -60                               | 76                                             |
| -60 ~ -50                               | 77                                             |
| -50 ~ -40                               | 78                                             |
| -40 ~ -30                               | 80                                             |
| -30 ~ -20                               | 81                                             |
| -20 ~ -10                               | 82                                             |
| -10 ~ 0                                 | 83                                             |
| 0 ~ 10                                  | 84                                             |
| 10 ~ 20                                 | 86                                             |
| 20 ~ 30                                 | 87                                             |
| 30 ~ 40                                 | 88                                             |
| 40 ~ 50                                 | 89                                             |
| 50 ~ 60                                 | 90                                             |
| 60 ~ 70                                 | 91                                             |
| 70 ~ 80                                 | 92                                             |
| 80 ~ 90                                 | 92                                             |
| 90 ~ 100                                | 93                                             |
| 100 ~ 110                               | 94                                             |
| 110 ~ 120                               | 95                                             |
| 120 ~ 130                               | 96                                             |
| 130 ~ 140                               | 96                                             |
| 140 ~ 150                               | 97                                             |
| 150 ~ 160                               | 98                                             |
| 160 ~ 170                               | 98                                             |
| 170 ~ 180                               | 99                                             |
| 180 ~ 190                               | 100                                            |
| 190 ~ 200                               | 100                                            |
| 200 ~ 210                               | 101                                            |
| 210 ~ 220                               | 101                                            |
| 220 ~ 230                               | 101                                            |
| 230 ~ 240                               | 102                                            |
| 240 ~ 250                               | 102                                            |
| 250 ~ 260                               | 103                                            |
| 260 ~ 270                               | 103                                            |
| 270 ~ 280                               | 103                                            |
| 280 ~ 290                               | 103                                            |
| 290 ~ 300                               | 104                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.36 |
| Specific Gravity $d$                                      | 4.71 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |     |     |     |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g   | h   | i   |
| -80 ~ -60                                    | -2.1                                                            | -1.9 | -1.5 | -1.3 | -1.3 | -0.9 | -0.7 | -0.1 | -0.1 | 0.7 | 1.5 | 3.2 |
| -60 ~ -40                                    | -2.2                                                            | -2.0 | -1.5 | -1.4 | -1.3 | -1.0 | -0.7 | -0.1 | 0.0  | 0.7 | 1.6 | 3.3 |
| -40 ~ -20                                    | -2.2                                                            | -2.0 | -1.4 | -1.3 | -1.2 | -0.9 | -0.6 | 0.0  | 0.1  | 0.9 | 1.8 | 3.5 |
| -20 ~ 0                                      | -2.1                                                            | -1.9 | -1.4 | -1.2 | -1.1 | -0.8 | -0.5 | 0.2  | 0.3  | 1.1 | 2.0 | 3.9 |
| 0 ~ 20                                       | -2.0                                                            | -1.8 | -1.2 | -1.0 | -1.0 | -0.7 | -0.4 | 0.4  | 0.5  | 1.3 | 2.2 | 4.2 |
| 20 ~ 40                                      | -1.9                                                            | -1.6 | -1.1 | -0.9 | -0.8 | -0.5 | -0.2 | 0.6  | 0.6  | 1.5 | 2.6 | 4.5 |
| 40 ~ 60                                      | -1.8                                                            | -1.5 | -0.9 | -0.7 | -0.6 | -0.3 | 0.0  | 0.8  | 0.9  | 1.9 | 2.9 | 4.9 |
| 60 ~ 80                                      | -1.7                                                            | -1.4 | -0.8 | -0.6 | -0.5 | -0.2 | 0.3  | 1.0  | 1.1  | 2.1 | 3.1 | 5.2 |
| 80 ~ 100                                     | -1.6                                                            | -1.3 | -0.6 | -0.4 | -0.3 | 0.0  | 0.4  | 1.2  | 1.3  | 2.3 | 3.4 | 5.6 |
| 100 ~ 120                                    | -1.5                                                            | -1.2 | -0.5 | -0.3 | -0.2 | 0.2  | 0.5  | 1.4  | 1.5  | 2.5 | 3.6 | 6.0 |
| 120 ~ 140                                    | -1.4                                                            | -1.1 | -0.4 | -0.2 | -0.1 | 0.3  | 0.7  | 1.5  | 1.6  | 2.7 | 3.8 | 6.2 |
| 140 ~ 160                                    | -1.4                                                            | -1.1 | -0.4 | -0.1 | -0.1 | 0.3  | 0.7  | 1.6  | 1.7  | 2.8 | 4.1 | 6.5 |
| 160 ~ 180                                    | -1.4                                                            | -1.1 | -0.3 | -0.1 | 0.0  | 0.5  | 0.9  | 1.8  | 1.9  | 3.0 | 4.2 | 6.7 |

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## S-LAH60V

Code(d) **834372**  
Code(e) **839370**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.834 00</b><br>1.834 000 | Abbe Number $\nu_d$ | <b>37.21</b> | Dispersion $n_F - n_C$       | <b>0.022 416</b> |
| Refractive Index $n_e$ | 1.839 313                    | Abbe Number $\nu_e$ | 36.95        | Dispersion $n_{F'} - n_{C'}$ | 0.022 716        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.786 08 |
| $n_{1970}$         | 1.970 09  | 1.793 01 |
| $n_{1530}$         | 1.529 58  | 1.800 73 |
| $n_{1129}$         | 1.128 64  | 1.808 33 |
| $n_t$              | 1.013 98  | 1.811 14 |
| $n_s$              | 0.852 11  | 1.816 38 |
| $n_{A'}$           | 0.768 19  | 1.820 16 |
| $n_F$              | 0.706 52  | 1.823 74 |
| $n_C$              | 0.656 27  | 1.827 40 |
| $n_{C'}$           | 0.643 85  | 1.828 44 |
| $n_{\text{He-Ne}}$ | 0.632 8   | 1.829 41 |
| $n_D$              | 0.589 29  | 1.833 80 |
| $n_d$              | 0.587 56  | 1.834 00 |
| $n_e$              | 0.546 07  | 1.839 31 |
| $n_F$              | 0.486 13  | 1.849 81 |
| $n_{F'}$           | 0.479 99  | 1.851 15 |
| $n_{\text{He-Cd}}$ | 0.441 57  | 1.861 07 |
| $n_g$              | 0.435 835 | 1.862 83 |
| $n_h$              | 0.404 656 | 1.874 12 |
| $n_i$              | 0.365 015 | 1.894 56 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.050 819 62E+00 |
| $A_2$                           | 2.084 752 57E-01 |
| $A_3$                           | 1.314 863 94E+00 |
| $B_1$                           | 1.160 359 91E-02 |
| $B_2$                           | 5.264 893 59E-02 |
| $B_3$                           | 9.938 065 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 1.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 111.4 |
| Rigidity Modulus G (GPa) | 44.5  |
| Poisson's Ratio $\sigma$ | 0.253 |
| Knoop Hardness Hk[Class] | 660 7 |
| Abrasion Aa              | 61    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.016 264 |
| $n_C - n_{A'}$      | 0.007 235 |
| $n_d - n_C$         | 0.006 601 |
| $n_e - n_C$         | 0.011 914 |
| $n_g - n_d$         | 0.028 833 |
| $n_g - n_F$         | 0.013 018 |
| $n_h - n_g$         | 0.011 289 |
| $n_i - n_g$         | 0.031 732 |
| $n_C - n_t$         | 0.017 300 |
| $n_e - n_{C'}$      | 0.010 878 |
| $n_{F'} - n_e$      | 0.011 838 |
| $n_i - n_{F'}$      | 0.043 414 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.725 6 |
| $\theta_{C,A'}$              | 0.322 8 |
| $\theta_{d,C}$               | 0.294 5 |
| $\theta_{e,C}$               | 0.531 5 |
| $\theta_{g,d}$               | 1.286 3 |
| $\theta_{g,F}$               | 0.580 7 |
| $\theta_{h,g}$               | 0.503 6 |
| $\theta_{i,g}$               | 1.415 6 |
| $\theta'_{C,t}$              | 0.761 6 |
| $\theta'_{e,C'}$             | 0.478 9 |
| $\theta'_{F,e}$              | 0.521 1 |
| $\theta'_{i,F'}$             | 1.911 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.004 3  |
| $\Delta\theta_{C,A'}$ | 0.001 8  |
| $\Delta\theta_{g,d}$  | -0.001 1 |
| $\Delta\theta_{g,F}$  | -0.000 6 |
| $\Delta\theta_{i,g}$  | 0.002 2  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 430  | $\lambda_5$      | 350 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 383  | $\lambda_{0.05}$ | 350 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.88 | 1.93             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.05             |
| 360                    | 0.29             |
| 370                    | 0.59             |
| 380                    | 0.77             |
| 390                    | 0.86             |
| 400                    | 0.909            |
| 420                    | 0.951            |
| 440                    | 0.968            |
| 460                    | 0.979            |
| 480                    | 0.986            |
| 500                    | 0.991            |
| 550                    | 0.996            |
| 600                    | 0.996            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.996            |
| 1 600                  | 0.993            |
| 1 800                  | 0.984            |
| 2 000                  | 0.961            |
| 2 200                  | 0.905            |
| 2 400                  | 0.72             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 570   |
| Annealing Point AP (°C)                                          | 588   |
| Transformation Temperature Tg (°C)                               | 608   |
| Yield Point At (°C)                                              | 639   |
| Softening Point SP (°C)                                          | 669   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 61    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 75    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.880 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 47                                             |
| -90 ~ -80                               | 48                                             |
| -80 ~ -70                               | 49                                             |
| -70 ~ -60                               | 51                                             |
| -60 ~ -50                               | 52                                             |
| -50 ~ -40                               | 53                                             |
| -40 ~ -30                               | 54                                             |
| -30 ~ -20                               | 56                                             |
| -20 ~ -10                               | 57                                             |
| -10 ~ 0                                 | 58                                             |
| 0 ~ 10                                  | 59                                             |
| 10 ~ 20                                 | 60                                             |
| 20 ~ 30                                 | 61                                             |
| 30 ~ 40                                 | 62                                             |
| 40 ~ 50                                 | 63                                             |
| 50 ~ 60                                 | 64                                             |
| 60 ~ 70                                 | 65                                             |
| 70 ~ 80                                 | 66                                             |
| 80 ~ 90                                 | 67                                             |
| 90 ~ 100                                | 68                                             |
| 100 ~ 110                               | 69                                             |
| 110 ~ 120                               | 70                                             |
| 120 ~ 130                               | 71                                             |
| 130 ~ 140                               | 71                                             |
| 140 ~ 150                               | 72                                             |
| 150 ~ 160                               | 73                                             |
| 160 ~ 170                               | 74                                             |
| 170 ~ 180                               | 74                                             |
| 180 ~ 190                               | 75                                             |
| 190 ~ 200                               | 76                                             |
| 200 ~ 210                               | 76                                             |
| 210 ~ 220                               | 77                                             |
| 220 ~ 230                               | 77                                             |
| 230 ~ 240                               | 78                                             |
| 240 ~ 250                               | 78                                             |
| 250 ~ 260                               | 79                                             |
| 260 ~ 270                               | 79                                             |
| 270 ~ 280                               | 80                                             |
| 280 ~ 290                               | 80                                             |
| 290 ~ 300                               | 81                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.10 |
| Specific Gravity $d$                                     | 4.43 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |      |      |      |      |      |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | 6.0                                                             | 6.3 | 6.9 | 7.1 | 7.1 | 7.5 | 7.8  | 8.5  | 8.6  | 9.5  | 10.4 | 12.4 |
| -60 ~ -40                                    | 5.9                                                             | 6.2 | 6.8 | 7.0 | 7.0 | 7.5 | 7.8  | 8.5  | 8.6  | 9.5  | 10.6 | 12.5 |
| -40 ~ -20                                    | 5.8                                                             | 6.1 | 6.8 | 7.0 | 7.1 | 7.5 | 7.8  | 8.6  | 8.7  | 9.7  | 10.8 | 12.9 |
| -20 ~ 0                                      | 5.8                                                             | 6.2 | 6.9 | 7.1 | 7.2 | 7.5 | 7.9  | 8.8  | 8.9  | 10.0 | 11.0 | 13.4 |
| 0 ~ 20                                       | 5.9                                                             | 6.3 | 7.0 | 7.2 | 7.3 | 7.7 | 8.1  | 9.1  | 9.2  | 10.2 | 11.4 | 13.8 |
| 20 ~ 40                                      | 6.0                                                             | 6.4 | 7.2 | 7.5 | 7.5 | 8.0 | 8.4  | 9.3  | 9.4  | 10.5 | 11.8 | 14.3 |
| 40 ~ 60                                      | 6.2                                                             | 6.6 | 7.4 | 7.7 | 7.7 | 8.2 | 8.6  | 9.6  | 9.7  | 11.0 | 12.2 | 14.8 |
| 60 ~ 80                                      | 6.3                                                             | 6.7 | 7.6 | 7.9 | 7.9 | 8.4 | 9.0  | 10.0 | 10.1 | 11.3 | 12.6 | 15.4 |
| 80 ~ 100                                     | 6.5                                                             | 6.9 | 7.8 | 8.1 | 8.2 | 8.7 | 9.2  | 10.2 | 10.4 | 11.7 | 13.1 | 16.0 |
| 100 ~ 120                                    | 6.7                                                             | 7.1 | 8.1 | 8.4 | 8.5 | 9.0 | 9.5  | 10.6 | 10.7 | 12.0 | 13.5 | 16.6 |
| 120 ~ 140                                    | 6.8                                                             | 7.3 | 8.3 | 8.6 | 8.7 | 9.2 | 9.7  | 10.9 | 11.0 | 12.4 | 13.9 | 17.1 |
| 140 ~ 160                                    | 7.0                                                             | 7.5 | 8.5 | 8.8 | 8.9 | 9.5 | 10.0 | 11.2 | 11.3 | 12.8 | 14.5 | 17.7 |
| 160 ~ 180                                    | 7.1                                                             | 7.6 | 8.7 | 9.0 | 9.2 | 9.8 | 10.3 | 11.6 | 11.7 | 13.2 | 14.9 | 18.2 |

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## S-LAH63Q

Code(d) 804396  
Code(e) 809393

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.804 40<br>1.804 400 | Abbe Number $\nu_d$ | 39.58 | Dispersion $n_F - n_C$       | 0.020 323 |
| Refractive Index $n_e$ | 1.809 222             | Abbe Number $\nu_e$ | 39.31 | Dispersion $n_{F'} - n_{C'}$ | 0.020 586 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.760 63 |
| $n_{1970}$         | 1.970 09  | 1.766 95 |
| $n_{1530}$         | 1.529 58  | 1.774 01 |
| $n_{1129}$         | 1.128 64  | 1.780 98 |
| $n_t$              | 1.013 98  | 1.783 55 |
| $n_s$              | 0.852 11  | 1.788 34 |
| $n_{A'}$           | 0.768 19  | 1.791 80 |
| $n_F$              | 0.706 52  | 1.795 07 |
| $n_C$              | 0.656 27  | 1.798 40 |
| $n_{C'}$           | 0.643 85  | 1.799 34 |
| $n_{\text{He-Ne}}$ | 0.632 8   | 1.800 23 |
| $n_D$              | 0.589 29  | 1.804 22 |
| $n_d$              | 0.587 56  | 1.804 40 |
| $n_e$              | 0.546 07  | 1.809 22 |
| $n_F$              | 0.486 13  | 1.818 72 |
| $n_{F'}$           | 0.479 99  | 1.819 93 |
| $n_{\text{He-Cd}}$ | 0.441 57  | 1.828 85 |
| $n_g$              | 0.435 835 | 1.830 43 |
| $n_h$              | 0.404 656 | 1.840 52 |
| $n_i$              | 0.365 015 | 1.858 62 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.967 230 17E+00 |
| $A_2$                           | 1.949 539 15E-01 |
| $A_3$                           | 1.253 862 82E+00 |
| $B_1$                           | 1.104 560 86E-02 |
| $B_2$                           | 4.971 370 61E-02 |
| $B_3$                           | 1.048 435 20E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 1.0  |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 102.6   |
| Rigidity Modulus G (GPa) | 39.5    |
| Poisson's Ratio $\sigma$ | 0.300   |
| Knoop Hardness Hk[Class] | 620   6 |
| Abrasion Aa              | 121     |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.014 851 |
| $n_C - n_{A'}$      | 0.006 597 |
| $n_d - n_C$         | 0.006 003 |
| $n_e - n_C$         | 0.010 825 |
| $n_g - n_d$         | 0.026 030 |
| $n_g - n_F$         | 0.011 710 |
| $n_h - n_g$         | 0.010 090 |
| $n_i - n_g$         | 0.028 188 |
| $n_{C'} - n_t$      | 0.015 794 |
| $n_e - n_{C'}$      | 0.009 882 |
| $n_{F'} - n_e$      | 0.010 704 |
| $n_i - n_{F'}$      | 0.038 692 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.730 7 |
| $\theta_{C,A'}$              | 0.324 6 |
| $\theta_{d,C}$               | 0.295 4 |
| $\theta_{e,C}$               | 0.532 6 |
| $\theta_{g,d}$               | 1.280 8 |
| $\theta_{g,F}$               | 0.576 2 |
| $\theta_{h,g}$               | 0.496 5 |
| $\theta_{i,g}$               | 1.387 0 |
| $\theta'_{C,t}$              | 0.767 2 |
| $\theta'_{e,C'}$             | 0.480 0 |
| $\theta'_{F',e}$             | 0.520 0 |
| $\theta'_{i,F'}$             | 1.879 5 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.001 7 |
| $\Delta\theta_{C,A'}$ | 0.000 8  |
| $\Delta\theta_{g,d}$  | -0.001 7 |
| $\Delta\theta_{g,F}$  | -0.001 2 |
| $\Delta\theta_{i,g}$  | -0.006 6 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 415  | $\lambda_5$      | 345 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 378  | $\lambda_{0.05}$ | 343 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.51 | 1.56             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.01             |
| 350                    | 0.14             |
| 360                    | 0.44             |
| 370                    | 0.69             |
| 380                    | 0.82             |
| 390                    | 0.89             |
| 400                    | 0.927            |
| 420                    | 0.959            |
| 440                    | 0.973            |
| 460                    | 0.981            |
| 480                    | 0.987            |
| 500                    | 0.991            |
| 550                    | 0.996            |
| 600                    | 0.996            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.995            |
| 1 800                  | 0.987            |
| 2 000                  | 0.968            |
| 2 200                  | 0.923            |
| 2 400                  | 0.77             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 626   |
| Annealing Point AP (°C)                                          | 654   |
| Transformation Temperature Tg (°C)                               | 671   |
| Yield Point At (°C)                                              | 705   |
| Softening Point SP (°C)                                          | 732   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 81    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 95    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.738 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 68                                             |
| -90 ~ -80                               | 69                                             |
| -80 ~ -70                               | 70                                             |
| -70 ~ -60                               | 71                                             |
| -60 ~ -50                               | 73                                             |
| -50 ~ -40                               | 74                                             |
| -40 ~ -30                               | 75                                             |
| -30 ~ -20                               | 76                                             |
| -20 ~ -10                               | 77                                             |
| -10 ~ 0                                 | 78                                             |
| 0 ~ 10                                  | 79                                             |
| 10 ~ 20                                 | 80                                             |
| 20 ~ 30                                 | 81                                             |
| 30 ~ 40                                 | 82                                             |
| 40 ~ 50                                 | 83                                             |
| 50 ~ 60                                 | 84                                             |
| 60 ~ 70                                 | 85                                             |
| 70 ~ 80                                 | 86                                             |
| 80 ~ 90                                 | 87                                             |
| 90 ~ 100                                | 88                                             |
| 100 ~ 110                               | 88                                             |
| 110 ~ 120                               | 89                                             |
| 120 ~ 130                               | 90                                             |
| 130 ~ 140                               | 91                                             |
| 140 ~ 150                               | 91                                             |
| 150 ~ 160                               | 92                                             |
| 160 ~ 170                               | 93                                             |
| 170 ~ 180                               | 94                                             |
| 180 ~ 190                               | 94                                             |
| 190 ~ 200                               | 95                                             |
| 200 ~ 210                               | 95                                             |
| 210 ~ 220                               | 96                                             |
| 220 ~ 230                               | 97                                             |
| 230 ~ 240                               | 97                                             |
| 240 ~ 250                               | 98                                             |
| 250 ~ 260                               | 98                                             |
| 260 ~ 270                               | 99                                             |
| 270 ~ 280                               | 99                                             |
| 280 ~ 290                               | 99                                             |
| 290 ~ 300                               | 100                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.39 |
| Specific Gravity $d$                                      | 4.45 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                        |      |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|------------------------------------------------------------------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{\text{rel}} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                                   | t    | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | -0.5                                                                   | -0.3 | 0.2 | 0.3 | 0.4 | 0.6 | 0.8 | 1.4 | 1.5 | 2.1 | 2.8 | 4.4 |
| -60 ~ -40                                    | -0.6                                                                   | -0.4 | 0.1 | 0.2 | 0.3 | 0.5 | 0.8 | 1.4 | 1.5 | 2.2 | 2.9 | 4.5 |
| -40 ~ -20                                    | -0.6                                                                   | -0.4 | 0.1 | 0.2 | 0.3 | 0.6 | 0.9 | 1.5 | 1.5 | 2.2 | 3.1 | 4.7 |
| -20 ~ 0                                      | -0.6                                                                   | -0.4 | 0.2 | 0.4 | 0.4 | 0.7 | 1.0 | 1.6 | 1.6 | 2.4 | 3.3 | 5.0 |
| 0 ~ 20                                       | -0.4                                                                   | -0.2 | 0.3 | 0.5 | 0.5 | 0.8 | 1.1 | 1.7 | 1.8 | 2.7 | 3.5 | 5.3 |
| 20 ~ 40                                      | -0.4                                                                   | -0.2 | 0.5 | 0.6 | 0.7 | 1.0 | 1.3 | 1.9 | 2.0 | 2.9 | 3.7 | 5.7 |
| 40 ~ 60                                      | -0.3                                                                   | 0.0  | 0.6 | 0.8 | 0.8 | 1.1 | 1.5 | 2.1 | 2.2 | 3.1 | 4.0 | 6.0 |
| 60 ~ 80                                      | -0.2                                                                   | 0.1  | 0.7 | 0.9 | 0.9 | 1.3 | 1.6 | 2.3 | 2.5 | 3.4 | 4.4 | 6.4 |
| 80 ~ 100                                     | 0.0                                                                    | 0.2  | 0.8 | 1.0 | 1.1 | 1.4 | 1.8 | 2.5 | 2.6 | 3.5 | 4.5 | 6.7 |
| 100 ~ 120                                    | 0.0                                                                    | 0.3  | 0.9 | 1.2 | 1.2 | 1.6 | 1.9 | 2.7 | 2.8 | 3.8 | 4.8 | 7.0 |
| 120 ~ 140                                    | 0.1                                                                    | 0.4  | 1.0 | 1.3 | 1.3 | 1.7 | 2.0 | 2.8 | 2.9 | 3.9 | 5.0 | 7.3 |
| 140 ~ 160                                    | 0.1                                                                    | 0.4  | 1.1 | 1.3 | 1.4 | 1.8 | 2.1 | 3.0 | 3.1 | 4.1 | 5.2 | 7.6 |
| 160 ~ 180                                    | 0.1                                                                    | 0.4  | 1.1 | 1.3 | 1.4 | 1.8 | 2.2 | 3.0 | 3.2 | 4.3 | 5.4 | 7.9 |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.788 00<br>1.788 001 | Abbe Number $\nu_d$ | 47.37 | Dispersion $n_F - n_C$       | 0.016 636 |
| Refractive Index $n_e$ | 1.791 961             | Abbe Number $\nu_e$ | 47.12 | Dispersion $n_{F'} - n_{C'}$ | 0.016 806 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.744 66 |
| $n_{1970}$         | 1.970 09  | 1.752 20 |
| $n_{1530}$         | 1.529 58  | 1.760 26 |
| $n_{1129}$         | 1.128 64  | 1.767 50 |
| $n_t$              | 1.013 98  | 1.769 96 |
| $n_s$              | 0.852 11  | 1.774 33 |
| $n_{A'}$           | 0.768 19  | 1.777 37 |
| $n_F$              | 0.706 52  | 1.780 18 |
| $n_C$              | 0.656 27  | 1.783 00 |
| $n_{C'}$           | 0.643 85  | 1.783 79 |
| $n_{He-Ne}$        | 0.632 8   | 1.784 53 |
| $n_D$              | 0.589 29  | 1.787 85 |
| $n_d$              | 0.587 56  | 1.788 00 |
| $n_e$              | 0.546 07  | 1.791 96 |
| $n_F$              | 0.486 13  | 1.799 63 |
| $n_{F'}$           | 0.479 99  | 1.800 60 |
| $n_{He-Cd}$        | 0.441 57  | 1.807 65 |
| $n_g$              | 0.435 835 | 1.808 88 |
| $n_h$              | 0.404 656 | 1.816 66 |
| $n_i$              | 0.365 015 | 1.830 16 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.830 214 53E+00 |
| $A_2$                           | 2.915 635 90E-01 |
| $A_3$                           | 1.285 440 24E+00 |
| $B_1$                           | 9.048 232 90E-03 |
| $B_2$                           | 3.307 566 89E-02 |
| $B_3$                           | 8.936 755 01E+01 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 122.4 |
| Rigidity Modulus G (GPa) | 47.3  |
| Poisson's Ratio $\sigma$ | 0.294 |
| Knoop Hardness Hk[Class] | 750 7 |
| Abrasion Aa              | 63    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.013 038 |
| $n_C - n_{A'}$      | 0.005 628 |
| $n_d - n_C$         | 0.005 003 |
| $n_e - n_C$         | 0.008 963 |
| $n_g - n_d$         | 0.020 881 |
| $n_g - n_F$         | 0.009 248 |
| $n_h - n_g$         | 0.007 782 |
| $n_i - n_g$         | 0.021 279 |
| $n_{C'} - n_t$      | 0.013 830 |
| $n_e - n_{C'}$      | 0.008 171 |
| $n_{F'} - n_e$      | 0.008 635 |
| $n_i - n_{F'}$      | 0.029 565 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.783 7 |
| $\theta_{C,A'}$              | 0.338 3 |
| $\theta_{d,C}$               | 0.300 7 |
| $\theta_{e,C}$               | 0.538 8 |
| $\theta_{g,d}$               | 1.255 2 |
| $\theta_{g,F}$               | 0.555 9 |
| $\theta_{h,g}$               | 0.467 8 |
| $\theta_{i,g}$               | 1.279 1 |
| $\theta'_{C,t}$              | 0.822 9 |
| $\theta'_{e,C'}$             | 0.486 2 |
| $\theta'_{F',e}$             | 0.513 8 |
| $\theta'_{i,F'}$             | 1.759 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.014 8  |
| $\Delta\theta_{C,A'}$ | 0.005 0  |
| $\Delta\theta_{g,d}$  | -0.011 1 |
| $\Delta\theta_{g,F}$  | -0.008 9 |
| $\Delta\theta_{i,g}$  | -0.049 3 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 380  | $\lambda_5$      | 315 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 354  | $\lambda_{0.05}$ | 317 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.63 | 0.65             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    | 0.13             |
| 330                    | 0.40             |
| 340                    | 0.63             |
| 350                    | 0.77             |
| 360                    | 0.85             |
| 370                    | 0.912            |
| 380                    | 0.943            |
| 390                    | 0.961            |
| 400                    | 0.972            |
| 420                    | 0.981            |
| 440                    | 0.986            |
| 460                    | 0.990            |
| 480                    | 0.993            |
| 500                    | 0.996            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.996            |
| 1 400                  | 0.995            |
| 1 600                  | 0.993            |
| 1 800                  | 0.987            |
| 2 000                  | 0.966            |
| 2 200                  | 0.915            |
| 2 400                  | 0.68             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 644   |
| Annealing Point AP (°C)                                          | 660   |
| Transformation Temperature Tg (°C)                               | 685   |
| Yield Point At (°C)                                              | 711   |
| Softening Point SP (°C)                                          | 732   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 62    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 76    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.856 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 49                                             |
| -90 ~ -80                               | 50                                             |
| -80 ~ -70                               | 51                                             |
| -70 ~ -60                               | 53                                             |
| -60 ~ -50                               | 54                                             |
| -50 ~ -40                               | 55                                             |
| -40 ~ -30                               | 56                                             |
| -30 ~ -20                               | 57                                             |
| -20 ~ -10                               | 58                                             |
| -10 ~ 0                                 | 59                                             |
| 0 ~ 10                                  | 60                                             |
| 10 ~ 20                                 | 61                                             |
| 20 ~ 30                                 | 62                                             |
| 30 ~ 40                                 | 63                                             |
| 40 ~ 50                                 | 64                                             |
| 50 ~ 60                                 | 65                                             |
| 60 ~ 70                                 | 66                                             |
| 70 ~ 80                                 | 67                                             |
| 80 ~ 90                                 | 68                                             |
| 90 ~ 100                                | 69                                             |
| 100 ~ 110                               | 69                                             |
| 110 ~ 120                               | 70                                             |
| 120 ~ 130                               | 71                                             |
| 130 ~ 140                               | 72                                             |
| 140 ~ 150                               | 72                                             |
| 150 ~ 160                               | 73                                             |
| 160 ~ 170                               | 74                                             |
| 170 ~ 180                               | 74                                             |
| 180 ~ 190                               | 75                                             |
| 190 ~ 200                               | 76                                             |
| 200 ~ 210                               | 76                                             |
| 210 ~ 220                               | 77                                             |
| 220 ~ 230                               | 77                                             |
| 230 ~ 240                               | 78                                             |
| 240 ~ 250                               | 78                                             |
| 250 ~ 260                               | 79                                             |
| 260 ~ 270                               | 79                                             |
| 270 ~ 280                               | 80                                             |
| 280 ~ 290                               | 80                                             |
| 290 ~ 300                               | 80                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.40 |
| Specific Gravity $d$                                     | 4.30 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.7                                                             | 2.8 | 3.1 | 3.3 | 3.4 | 3.5 | 3.7 | 4.0 | 4.1 | 4.5 | 4.9 | 5.8 |
| -60 ~ -40                                    | 2.5                                                             | 2.6 | 3.0 | 3.2 | 3.2 | 3.4 | 3.5 | 3.9 | 3.9 | 4.5 | 4.9 | 5.7 |
| -40 ~ -20                                    | 2.4                                                             | 2.6 | 3.0 | 3.1 | 3.1 | 3.3 | 3.5 | 4.0 | 4.0 | 4.5 | 4.9 | 5.9 |
| -20 ~ 0                                      | 2.4                                                             | 2.6 | 3.0 | 3.2 | 3.2 | 3.4 | 3.6 | 4.0 | 4.1 | 4.5 | 5.0 | 6.1 |
| 0 ~ 20                                       | 2.4                                                             | 2.7 | 3.1 | 3.2 | 3.3 | 3.5 | 3.7 | 4.1 | 4.2 | 4.7 | 5.3 | 6.3 |
| 20 ~ 40                                      | 2.5                                                             | 2.7 | 3.2 | 3.4 | 3.4 | 3.7 | 3.9 | 4.3 | 4.4 | 4.9 | 5.5 | 6.5 |
| 40 ~ 60                                      | 2.6                                                             | 2.8 | 3.4 | 3.5 | 3.6 | 3.8 | 4.0 | 4.5 | 4.6 | 5.2 | 5.7 | 6.9 |
| 60 ~ 80                                      | 2.8                                                             | 3.0 | 3.5 | 3.6 | 3.7 | 3.9 | 4.2 | 4.7 | 4.8 | 5.4 | 6.1 | 7.2 |
| 80 ~ 100                                     | 2.8                                                             | 3.2 | 3.7 | 3.8 | 3.9 | 4.2 | 4.4 | 4.9 | 5.0 | 5.6 | 6.3 | 7.5 |
| 100 ~ 120                                    | 3.1                                                             | 3.3 | 3.8 | 4.0 | 4.1 | 4.3 | 4.6 | 5.2 | 5.2 | 5.9 | 6.6 | 7.8 |
| 120 ~ 140                                    | 3.2                                                             | 3.5 | 4.0 | 4.2 | 4.2 | 4.5 | 4.8 | 5.4 | 5.4 | 6.1 | 6.8 | 8.2 |
| 140 ~ 160                                    | 3.3                                                             | 3.6 | 4.1 | 4.3 | 4.4 | 4.7 | 4.9 | 5.6 | 5.6 | 6.4 | 7.1 | 8.6 |
| 160 ~ 180                                    | 3.3                                                             | 3.6 | 4.2 | 4.4 | 4.5 | 4.8 | 5.1 | 5.7 | 5.8 | 6.7 | 7.4 | 8.8 |

## S-LAH65V

Code(d) 804466

Code(e) 808463

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.804 00<br>1.804 000 | Abbe Number $\nu_d$ | 46.58 | Dispersion $n_F - n_C$       | 0.017 259 |
| Refractive Index $n_e$ | 1.808 107             | Abbe Number $\nu_e$ | 46.34 | Dispersion $n_{F'} - n_{C'}$ | 0.017 440 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.759 86 |
| $n_{1970}$         | 1.970 09  | 1.767 41 |
| $n_{1530}$         | 1.529 58  | 1.775 52 |
| $n_{1129}$         | 1.128 64  | 1.782 86 |
| $n_t$              | 1.013 98  | 1.785 38 |
| $n_s$              | 0.852 11  | 1.789 87 |
| $n_{A'}$           | 0.768 19  | 1.793 00 |
| $n_F$              | 0.706 52  | 1.795 90 |
| $n_C$              | 0.656 27  | 1.798 82 |
| $n_{C'}$           | 0.643 85  | 1.799 64 |
| $n_{He-Ne}$        | 0.632 8   | 1.800 41 |
| $n_D$              | 0.589 29  | 1.803 85 |
| $n_d$              | 0.587 56  | 1.804 00 |
| $n_e$              | 0.546 07  | 1.808 11 |
| $n_F$              | 0.486 13  | 1.816 08 |
| $n_{F'}$           | 0.479 99  | 1.817 08 |
| $n_{He-Cd}$        | 0.441 57  | 1.824 41 |
| $n_g$              | 0.435 835 | 1.825 69 |
| $n_h$              | 0.404 656 | 1.833 80 |
| $n_i$              | 0.365 015 | 1.847 86 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.814 190 34E+00 |
| $A_2$                           | 3.613 763 01E-01 |
| $A_3$                           | 1.327 294 84E+00 |
| $B_1$                           | 8.749 350 29E-03 |
| $B_2$                           | 3.183 528 36E-02 |
| $B_3$                           | 9.134 068 98E+01 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 3   |
| Acid Resistance(Surface) Group SR         | 4.1 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 122.0 |
| Rigidity Modulus G (GPa) | 47.0  |
| Poisson's Ratio $\sigma$ | 0.298 |
| Knoop Hardness Hk[Class] | 730 7 |
| Abrasion Aa              | 57    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.013 439 |
| $n_C - n_{A'}$      | 0.005 818 |
| $n_d - n_C$         | 0.005 183 |
| $n_e - n_C$         | 0.009 290 |
| $n_g - n_d$         | 0.021 694 |
| $n_g - n_F$         | 0.009 618 |
| $n_h - n_g$         | 0.008 101 |
| $n_i - n_g$         | 0.022 167 |
| $n_{C'} - n_t$      | 0.014 259 |
| $n_e - n_{C'}$      | 0.008 470 |
| $n_{F'} - n_e$      | 0.008 970 |
| $n_i - n_{F'}$      | 0.030 784 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.778 7 |
| $\theta_{C,A'}$              | 0.337 1 |
| $\theta_{d,C}$               | 0.300 3 |
| $\theta_{e,C}$               | 0.538 3 |
| $\theta_{g,d}$               | 1.257 0 |
| $\theta_{g,F}$               | 0.557 3 |
| $\theta_{h,g}$               | 0.469 4 |
| $\theta_{i,g}$               | 1.284 4 |
| $\theta'_{C,t}$              | 0.817 6 |
| $\theta'_{e,C'}$             | 0.485 7 |
| $\theta'_{F,e}$              | 0.514 3 |
| $\theta'_{i,F'}$             | 1.765 1 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.013 5  |
| $\Delta\theta_{C,A'}$ | 0.004 8  |
| $\Delta\theta_{g,d}$  | -0.011 0 |
| $\Delta\theta_{g,F}$  | -0.008 8 |
| $\Delta\theta_{i,g}$  | -0.050 6 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 385  | $\lambda_5$      | 315 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 355  | $\lambda_{0.05}$ | 319 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.65 | 0.67             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    | 0.11             |
| 330                    | 0.37             |
| 340                    | 0.60             |
| 350                    | 0.75             |
| 360                    | 0.85             |
| 370                    | 0.906            |
| 380                    | 0.939            |
| 390                    | 0.959            |
| 400                    | 0.970            |
| 420                    | 0.981            |
| 440                    | 0.986            |
| 460                    | 0.990            |
| 480                    | 0.993            |
| 500                    | 0.996            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.989            |
| 2 000                  | 0.967            |
| 2 200                  | 0.910            |
| 2 400                  | 0.68             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 639   |
| Annealing Point AP (°C)                                          | 664   |
| Transformation Temperature Tg (°C)                               | 690   |
| Yield Point At (°C)                                              | 716   |
| Softening Point SP (°C)                                          | 740   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 63    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 75    |
| Thermal Conductivity $\lambda$ (W/(mK))                          | 0.841 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 50                                             |
| -90 ~ -80                               | 51                                             |
| -80 ~ -70                               | 52                                             |
| -70 ~ -60                               | 54                                             |
| -60 ~ -50                               | 55                                             |
| -50 ~ -40                               | 56                                             |
| -40 ~ -30                               | 57                                             |
| -30 ~ -20                               | 58                                             |
| -20 ~ -10                               | 59                                             |
| -10 ~ 0                                 | 60                                             |
| 0 ~ 10                                  | 61                                             |
| 10 ~ 20                                 | 62                                             |
| 20 ~ 30                                 | 63                                             |
| 30 ~ 40                                 | 64                                             |
| 40 ~ 50                                 | 65                                             |
| 50 ~ 60                                 | 66                                             |
| 60 ~ 70                                 | 67                                             |
| 70 ~ 80                                 | 67                                             |
| 80 ~ 90                                 | 68                                             |
| 90 ~ 100                                | 69                                             |
| 100 ~ 110                               | 70                                             |
| 110 ~ 120                               | 71                                             |
| 120 ~ 130                               | 71                                             |
| 130 ~ 140                               | 72                                             |
| 140 ~ 150                               | 73                                             |
| 150 ~ 160                               | 73                                             |
| 160 ~ 170                               | 74                                             |
| 170 ~ 180                               | 74                                             |
| 180 ~ 190                               | 75                                             |
| 190 ~ 200                               | 75                                             |
| 200 ~ 210                               | 76                                             |
| 210 ~ 220                               | 76                                             |
| 220 ~ 230                               | 77                                             |
| 230 ~ 240                               | 77                                             |
| 240 ~ 250                               | 78                                             |
| 250 ~ 260                               | 78                                             |
| 260 ~ 270                               | 78                                             |
| 270 ~ 280                               | 79                                             |
| 280 ~ 290                               | 79                                             |
| 290 ~ 300                               | 79                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.44 |
| Specific Gravity $d$                                     | 4.72 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.6                                                             | 2.8 | 3.2 | 3.3 | 3.4 | 3.6 | 3.7 | 4.2 | 4.3 | 4.7 | 5.2 | 6.2 |
| -60 ~ -40                                    | 2.6                                                             | 2.7 | 3.2 | 3.3 | 3.3 | 3.5 | 3.7 | 4.2 | 4.2 | 4.7 | 5.2 | 6.2 |
| -40 ~ -20                                    | 2.6                                                             | 2.8 | 3.2 | 3.3 | 3.3 | 3.6 | 3.8 | 4.2 | 4.3 | 4.8 | 5.3 | 6.4 |
| -20 ~ 0                                      | 2.7                                                             | 2.8 | 3.3 | 3.5 | 3.5 | 3.7 | 3.9 | 4.3 | 4.4 | 4.9 | 5.5 | 6.6 |
| 0 ~ 20                                       | 2.7                                                             | 3.1 | 3.5 | 3.6 | 3.6 | 3.9 | 4.1 | 4.5 | 4.6 | 5.2 | 5.8 | 6.8 |
| 20 ~ 40                                      | 2.9                                                             | 3.1 | 3.7 | 3.8 | 3.8 | 4.1 | 4.3 | 4.8 | 4.8 | 5.4 | 5.9 | 7.2 |
| 40 ~ 60                                      | 3.0                                                             | 3.4 | 3.8 | 4.0 | 4.0 | 4.2 | 4.5 | 4.9 | 5.0 | 5.6 | 6.2 | 7.4 |
| 60 ~ 80                                      | 3.2                                                             | 3.5 | 3.9 | 4.1 | 4.1 | 4.4 | 4.6 | 5.1 | 5.3 | 5.9 | 6.5 | 7.7 |
| 80 ~ 100                                     | 3.4                                                             | 3.6 | 4.1 | 4.3 | 4.3 | 4.6 | 4.8 | 5.3 | 5.4 | 6.0 | 6.7 | 8.0 |
| 100 ~ 120                                    | 3.5                                                             | 3.8 | 4.3 | 4.4 | 4.5 | 4.7 | 5.0 | 5.5 | 5.6 | 6.2 | 6.9 | 8.2 |
| 120 ~ 140                                    | 3.6                                                             | 3.9 | 4.4 | 4.5 | 4.6 | 4.9 | 5.1 | 5.7 | 5.7 | 6.4 | 7.1 | 8.4 |
| 140 ~ 160                                    | 3.6                                                             | 3.9 | 4.4 | 4.6 | 4.7 | 4.9 | 5.2 | 5.8 | 5.9 | 6.5 | 7.2 | 8.7 |
| 160 ~ 180                                    | 3.7                                                             | 3.9 | 4.5 | 4.6 | 4.7 | 5.0 | 5.3 | 5.9 | 6.0 | 6.7 | 7.5 | 8.8 |

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## S-LAH65VS

Code(d) 804465

Code(e) 808463

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.804 00<br>1.804 000 | Abbe Number $\nu_d$ | 46.53 | Dispersion $n_F - n_C$       | 0.017 281 |
| Refractive Index $n_e$ | 1.808 112             | Abbe Number $\nu_e$ | 46.28 | Dispersion $n_{F'} - n_{C'}$ | 0.017 463 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.761 27 |
| $n_{1970}$         | 1.970 09  | 1.768 33 |
| $n_{1530}$         | 1.529 58  | 1.775 97 |
| $n_{1129}$         | 1.128 64  | 1.783 03 |
| $n_t$              | 1.013 98  | 1.785 48 |
| $n_s$              | 0.852 11  | 1.789 91 |
| $n_{A'}$           | 0.768 19  | 1.793 02 |
| $n_F$              | 0.706 52  | 1.795 90 |
| $n_C$              | 0.656 27  | 1.798 82 |
| $n_{C'}$           | 0.643 85  | 1.799 64 |
| $n_{\text{He-Ne}}$ | 0.632 8   | 1.800 40 |
| $n_D$              | 0.589 29  | 1.803 85 |
| $n_d$              | 0.587 56  | 1.804 00 |
| $n_e$              | 0.546 07  | 1.808 11 |
| $n_F$              | 0.486 13  | 1.816 10 |
| $n_{F'}$           | 0.479 99  | 1.817 10 |
| $n_{\text{He-Cd}}$ | 0.441 57  | 1.824 45 |
| $n_g$              | 0.435 835 | 1.825 73 |
| $n_h$              | 0.404 656 | 1.833 85 |
| $n_i$              | 0.365 015 | 1.847 92 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.760 684 22E+00 |
| $A_2$                           | 4.141 289 06E-01 |
| $A_3$                           | 1.334 154 39E+00 |
| $B_1$                           | 8.536 071 98E-03 |
| $B_2$                           | 3.018 263 83E-02 |
| $B_3$                           | 9.809 421 00E+01 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 122.3 |   |
| Rigidity Modulus G (GPa) | 47.1  |   |
| Poisson's Ratio $\sigma$ | 0.300 |   |
| Knoop Hardness Hk[Class] | 720   | 7 |
| Abrasion Aa              | 61    |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.013 334 |
| $n_C - n_{A'}$      | 0.005 801 |
| $n_d - n_C$         | 0.005 184 |
| $n_e - n_C$         | 0.009 296 |
| $n_g - n_d$         | 0.021 734 |
| $n_g - n_F$         | 0.009 637 |
| $n_h - n_g$         | 0.008 114 |
| $n_i - n_g$         | 0.022 188 |
| $n_{C'} - n_t$      | 0.014 154 |
| $n_e - n_{C'}$      | 0.008 476 |
| $n_{F'} - n_e$      | 0.008 987 |
| $n_i - n_{F'}$      | 0.030 823 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.771 6 |
| $\theta_{C,A'}$              | 0.335 7 |
| $\theta_{d,C}$               | 0.300 0 |
| $\theta_{e,C}$               | 0.537 9 |
| $\theta_{g,d}$               | 1.257 7 |
| $\theta_{g,F}$               | 0.557 7 |
| $\theta_{h,g}$               | 0.469 5 |
| $\theta_{i,g}$               | 1.284 0 |
| $\theta'_{C,t}$              | 0.810 5 |
| $\theta'_{e,C'}$             | 0.485 4 |
| $\theta'_{F,e}$              | 0.514 6 |
| $\theta'_{i,F'}$             | 1.765 0 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.006 6  |
| $\Delta\theta_{C,A'}$ | 0.003 4  |
| $\Delta\theta_{g,d}$  | -0.010 4 |
| $\Delta\theta_{g,F}$  | -0.008 5 |
| $\Delta\theta_{i,g}$  | -0.051 4 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 380  | $\lambda_5$      | 310 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 347  | $\lambda_{0.05}$ | 310 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.40 | 0.42             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.05             |
| 320                    | 0.25             |
| 330                    | 0.53             |
| 340                    | 0.72             |
| 350                    | 0.83             |
| 360                    | 0.89             |
| 370                    | 0.934            |
| 380                    | 0.957            |
| 390                    | 0.971            |
| 400                    | 0.979            |
| 420                    | 0.987            |
| 440                    | 0.991            |
| 460                    | 0.993            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.996            |
| 1 800                  | 0.989            |
| 2 000                  | 0.968            |
| 2 200                  | 0.916            |
| 2 400                  | 0.72             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 648   |
| Annealing Point AP (°C)                                          | 677   |
| Transformation Temperature Tg (°C)                               | 696   |
| Yield Point At (°C)                                              | 728   |
| Softening Point SP (°C)                                          | 745   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 65    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 79    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.856 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 51                                             |
| -90 ~ -80                               | 53                                             |
| -80 ~ -70                               | 54                                             |
| -70 ~ -60                               | 55                                             |
| -60 ~ -50                               | 57                                             |
| -50 ~ -40                               | 58                                             |
| -40 ~ -30                               | 59                                             |
| -30 ~ -20                               | 60                                             |
| -20 ~ -10                               | 61                                             |
| -10 ~ 0                                 | 63                                             |
| 0 ~ 10                                  | 64                                             |
| 10 ~ 20                                 | 65                                             |
| 20 ~ 30                                 | 66                                             |
| 30 ~ 40                                 | 67                                             |
| 40 ~ 50                                 | 68                                             |
| 50 ~ 60                                 | 69                                             |
| 60 ~ 70                                 | 70                                             |
| 70 ~ 80                                 | 71                                             |
| 80 ~ 90                                 | 71                                             |
| 90 ~ 100                                | 72                                             |
| 100 ~ 110                               | 73                                             |
| 110 ~ 120                               | 74                                             |
| 120 ~ 130                               | 75                                             |
| 130 ~ 140                               | 75                                             |
| 140 ~ 150                               | 76                                             |
| 150 ~ 160                               | 77                                             |
| 160 ~ 170                               | 78                                             |
| 170 ~ 180                               | 78                                             |
| 180 ~ 190                               | 79                                             |
| 190 ~ 200                               | 79                                             |
| 200 ~ 210                               | 80                                             |
| 210 ~ 220                               | 81                                             |
| 220 ~ 230                               | 81                                             |
| 230 ~ 240                               | 82                                             |
| 240 ~ 250                               | 82                                             |
| 250 ~ 260                               | 82                                             |
| 260 ~ 270                               | 83                                             |
| 270 ~ 280                               | 83                                             |
| 280 ~ 290                               | 84                                             |
| 290 ~ 300                               | 84                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.27 |
| Specific Gravity $d$                                     | 4.46 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                        |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{\text{rel}} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                                   | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.5                                                                    | 2.7 | 3.1 | 3.2 | 3.3 | 3.5 | 3.6 | 4.1 | 4.2 | 4.6 | 5.1 | 6.1 |
| -60 ~ -40                                    | 2.4                                                                    | 2.6 | 3.0 | 3.1 | 3.2 | 3.4 | 3.6 | 4.1 | 4.1 | 4.6 | 5.1 | 6.2 |
| -40 ~ -20                                    | 2.4                                                                    | 2.6 | 3.0 | 3.1 | 3.1 | 3.4 | 3.6 | 4.1 | 4.1 | 4.7 | 5.2 | 6.3 |
| -20 ~ 0                                      | 2.4                                                                    | 2.6 | 3.1 | 3.2 | 3.3 | 3.5 | 3.7 | 4.2 | 4.2 | 4.8 | 5.4 | 6.5 |
| 0 ~ 20                                       | 2.4                                                                    | 2.8 | 3.2 | 3.3 | 3.4 | 3.6 | 3.8 | 4.3 | 4.4 | 5.0 | 5.6 | 6.7 |
| 20 ~ 40                                      | 2.6                                                                    | 2.8 | 3.3 | 3.5 | 3.5 | 3.8 | 4.0 | 4.5 | 4.6 | 5.1 | 5.7 | 7.0 |
| 40 ~ 60                                      | 2.8                                                                    | 3.0 | 3.5 | 3.6 | 3.7 | 3.9 | 4.2 | 4.7 | 4.7 | 5.3 | 6.0 | 7.2 |
| 60 ~ 80                                      | 2.8                                                                    | 3.1 | 3.6 | 3.7 | 3.8 | 4.0 | 4.3 | 4.8 | 5.0 | 5.6 | 6.2 | 7.5 |
| 80 ~ 100                                     | 3.0                                                                    | 3.2 | 3.7 | 3.9 | 3.9 | 4.2 | 4.5 | 5.0 | 5.1 | 5.7 | 6.4 | 7.8 |
| 100 ~ 120                                    | 3.1                                                                    | 3.4 | 3.9 | 4.0 | 4.1 | 4.4 | 4.6 | 5.2 | 5.3 | 5.9 | 6.6 | 7.9 |
| 120 ~ 140                                    | 3.2                                                                    | 3.4 | 4.0 | 4.1 | 4.2 | 4.5 | 4.8 | 5.3 | 5.4 | 6.1 | 6.8 | 8.2 |
| 140 ~ 160                                    | 3.2                                                                    | 3.5 | 4.0 | 4.2 | 4.3 | 4.6 | 4.9 | 5.4 | 5.5 | 6.2 | 7.0 | 8.4 |
| 160 ~ 180                                    | 3.2                                                                    | 3.5 | 4.1 | 4.3 | 4.3 | 4.6 | 4.9 | 5.5 | 5.7 | 6.4 | 7.2 | 8.6 |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.772 50<br>1.772 499 | Abbe Number $\nu_d$ | 49.60 | Dispersion $n_F - n_C$       | 0.015 576 |
| Refractive Index $n_e$ | 1.776 208             | Abbe Number $\nu_e$ | 49.36 | Dispersion $n_{F'} - n_{C'}$ | 0.015 727 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.730 31 |
| $n_{1970}$         | 1.970 09  | 1.737 86 |
| $n_{1530}$         | 1.529 58  | 1.745 90 |
| $n_{1129}$         | 1.128 64  | 1.753 03 |
| $n_t$              | 1.013 98  | 1.755 41 |
| $n_s$              | 0.852 11  | 1.759 60 |
| $n_{A'}$           | 0.768 19  | 1.762 48 |
| $n_F$              | 0.706 52  | 1.765 14 |
| $n_C$              | 0.656 27  | 1.767 80 |
| $n_{C'}$           | 0.643 85  | 1.768 54 |
| $n_{He-Ne}$        | 0.632 8   | 1.769 24 |
| $n_D$              | 0.589 29  | 1.772 36 |
| $n_d$              | 0.587 56  | 1.772 50 |
| $n_e$              | 0.546 07  | 1.776 21 |
| $n_F$              | 0.486 13  | 1.783 37 |
| $n_{F'}$           | 0.479 99  | 1.784 27 |
| $n_{He-Cd}$        | 0.441 57  | 1.790 83 |
| $n_g$              | 0.435 835 | 1.791 97 |
| $n_h$              | 0.404 656 | 1.799 17 |
| $n_i$              | 0.365 015 | 1.811 58 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.392 805 86E+00 |
| $A_2$                           | 6.795 770 94E-01 |
| $A_3$                           | 1.387 020 69E+00 |
| $B_1$                           | 6.084 751 18E-03 |
| $B_2$                           | 2.339 253 51E-02 |
| $B_3$                           | 9.583 540 94E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 1.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 121.9 |
| Rigidity Modulus G (GPa) | 47.2  |
| Poisson's Ratio $\sigma$ | 0.291 |
| Knoop Hardness Hk[Class] | 700 7 |
| Abrasion Aa              | 61    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.012 391 |
| $n_C - n_{A'}$      | 0.005 314 |
| $n_d - n_C$         | 0.004 701 |
| $n_e - n_C$         | 0.008 410 |
| $n_g - n_d$         | 0.019 473 |
| $n_g - n_F$         | 0.008 598 |
| $n_h - n_g$         | 0.007 202 |
| $n_i - n_g$         | 0.019 610 |
| $n_{C'} - n_t$      | 0.013 137 |
| $n_e - n_{C'}$      | 0.007 664 |
| $n_{F'} - n_e$      | 0.008 063 |
| $n_i - n_{F'}$      | 0.027 311 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.795 5 |
| $\theta_{C,A'}$              | 0.341 2 |
| $\theta_{d,C}$               | 0.301 8 |
| $\theta_{e,C}$               | 0.539 9 |
| $\theta_{g,d}$               | 1.250 2 |
| $\theta_{g,F}$               | 0.552 0 |
| $\theta_{h,g}$               | 0.462 4 |
| $\theta_{i,g}$               | 1.259 0 |
| $\theta'_{C,t}$              | 0.835 3 |
| $\theta'_{e,C'}$             | 0.487 3 |
| $\theta'_{F,e}$              | 0.512 7 |
| $\theta'_{i,F'}$             | 1.736 6 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.016 1  |
| $\Delta\theta_{C,A'}$ | 0.005 2  |
| $\Delta\theta_{g,d}$  | -0.011 5 |
| $\Delta\theta_{g,F}$  | -0.009 2 |
| $\Delta\theta_{i,g}$  | -0.050 7 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 370  | $\lambda_5$      | 305 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 349  | $\lambda_{0.05}$ | 308 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.44 | 0.42             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.10             |
| 320                    | 0.33             |
| 330                    | 0.55             |
| 340                    | 0.71             |
| 350                    | 0.81             |
| 360                    | 0.88             |
| 370                    | 0.930            |
| 380                    | 0.956            |
| 390                    | 0.971            |
| 400                    | 0.979            |
| 420                    | 0.987            |
| 440                    | 0.991            |
| 460                    | 0.994            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.997            |
| 1 400                  | 0.993            |
| 1 600                  | 0.993            |
| 1 800                  | 0.983            |
| 2 000                  | 0.958            |
| 2 200                  | 0.88             |
| 2 400                  | 0.64             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 641   |
| Annealing Point AP (°C)                                          | 660   |
| Transformation Temperature Tg (°C)                               | 686   |
| Yield Point At (°C)                                              | 706   |
| Softening Point SP (°C)                                          | 726   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 61    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 74    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.845 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 49                                             |
| -90 ~ -80                               | 50                                             |
| -80 ~ -70                               | 51                                             |
| -70 ~ -60                               | 52                                             |
| -60 ~ -50                               | 53                                             |
| -50 ~ -40                               | 54                                             |
| -40 ~ -30                               | 55                                             |
| -30 ~ -20                               | 56                                             |
| -20 ~ -10                               | 57                                             |
| -10 ~ 0                                 | 58                                             |
| 0 ~ 10                                  | 59                                             |
| 10 ~ 20                                 | 60                                             |
| 20 ~ 30                                 | 61                                             |
| 30 ~ 40                                 | 62                                             |
| 40 ~ 50                                 | 63                                             |
| 50 ~ 60                                 | 64                                             |
| 60 ~ 70                                 | 65                                             |
| 70 ~ 80                                 | 66                                             |
| 80 ~ 90                                 | 66                                             |
| 90 ~ 100                                | 67                                             |
| 100 ~ 110                               | 68                                             |
| 110 ~ 120                               | 69                                             |
| 120 ~ 130                               | 70                                             |
| 130 ~ 140                               | 70                                             |
| 140 ~ 150                               | 71                                             |
| 150 ~ 160                               | 72                                             |
| 160 ~ 170                               | 72                                             |
| 170 ~ 180                               | 73                                             |
| 180 ~ 190                               | 74                                             |
| 190 ~ 200                               | 74                                             |
| 200 ~ 210                               | 75                                             |
| 210 ~ 220                               | 76                                             |
| 220 ~ 230                               | 76                                             |
| 230 ~ 240                               | 77                                             |
| 240 ~ 250                               | 77                                             |
| 250 ~ 260                               | 78                                             |
| 260 ~ 270                               | 79                                             |
| 270 ~ 280                               | 79                                             |
| 280 ~ 290                               | 80                                             |
| 290 ~ 300                               | 80                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.43 |
| Specific Gravity $d$                                     | 4.23 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.6                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.3 | 3.6 | 3.9 | 3.9 | 4.3 | 4.8 | 5.5 |
| -60 ~ -40                                    | 2.4                                                             | 2.6 | 2.9 | 3.0 | 3.1 | 3.3 | 3.5 | 3.8 | 3.9 | 4.3 | 4.8 | 5.5 |
| -40 ~ -20                                    | 2.4                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.3 | 3.5 | 3.9 | 3.9 | 4.4 | 4.8 | 5.6 |
| -20 ~ 0                                      | 2.5                                                             | 2.7 | 3.0 | 3.2 | 3.2 | 3.5 | 3.7 | 4.0 | 4.1 | 4.5 | 5.0 | 5.9 |
| 0 ~ 20                                       | 2.6                                                             | 2.8 | 3.3 | 3.4 | 3.4 | 3.6 | 3.8 | 4.2 | 4.2 | 4.7 | 5.1 | 6.1 |
| 20 ~ 40                                      | 2.8                                                             | 2.9 | 3.3 | 3.5 | 3.5 | 3.7 | 4.0 | 4.4 | 4.4 | 4.9 | 5.4 | 6.3 |
| 40 ~ 60                                      | 2.9                                                             | 3.1 | 3.5 | 3.7 | 3.7 | 4.0 | 4.2 | 4.6 | 4.6 | 5.1 | 5.6 | 6.5 |
| 60 ~ 80                                      | 3.1                                                             | 3.3 | 3.7 | 3.8 | 3.9 | 4.1 | 4.3 | 4.7 | 4.8 | 5.3 | 5.9 | 6.8 |
| 80 ~ 100                                     | 3.1                                                             | 3.4 | 3.9 | 4.0 | 4.1 | 4.3 | 4.5 | 4.9 | 5.0 | 5.5 | 6.0 | 7.0 |
| 100 ~ 120                                    | 3.2                                                             | 3.5 | 4.0 | 4.2 | 4.2 | 4.4 | 4.7 | 5.1 | 5.2 | 5.7 | 6.3 | 7.3 |
| 120 ~ 140                                    | 3.3                                                             | 3.7 | 4.1 | 4.3 | 4.3 | 4.5 | 4.8 | 5.3 | 5.3 | 5.9 | 6.4 | 7.5 |
| 140 ~ 160                                    | 3.5                                                             | 3.7 | 4.2 | 4.4 | 4.4 | 4.6 | 4.9 | 5.4 | 5.4 | 6.0 | 6.6 | 7.6 |
| 160 ~ 180                                    | 3.5                                                             | 3.8 | 4.2 | 4.4 | 4.4 | 4.7 | 4.9 | 5.4 | 5.5 | 6.1 | 6.7 | 7.9 |

S-LAH66N

Code(d) 773496  
Code(e) 776493

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.772 50<br>1.772 499 | Abbe Number $\nu_d$ | 49.55 | Dispersion $n_F - n_C$       | 0.015 591 |
| Refractive Index $n_e$ | 1.776 212             | Abbe Number $\nu_e$ | 49.31 | Dispersion $n_{F'} - n_{C'}$ | 0.015 742 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.730 20 |
| $n_{1970}$         | 1.970 09  | 1.737 81 |
| $n_{1530}$         | 1.529 58  | 1.745 87 |
| $n_{1129}$         | 1.128 64  | 1.753 00 |
| $n_t$              | 1.013 98  | 1.755 39 |
| $n_s$              | 0.852 11  | 1.759 58 |
| $n_{A'}$           | 0.768 19  | 1.762 47 |
| $n_F$              | 0.706 52  | 1.765 13 |
| $n_C$              | 0.656 27  | 1.767 79 |
| $n_{C'}$           | 0.643 85  | 1.768 54 |
| $n_{He-Ne}$        | 0.632 8   | 1.769 24 |
| $n_D$              | 0.589 29  | 1.772 36 |
| $n_d$              | 0.587 56  | 1.772 50 |
| $n_e$              | 0.546 07  | 1.776 21 |
| $n_F$              | 0.486 13  | 1.783 38 |
| $n_{F'}$           | 0.479 99  | 1.784 28 |
| $n_{He-Cd}$        | 0.441 57  | 1.790 84 |
| $n_g$              | 0.435 835 | 1.791 99 |
| $n_h$              | 0.404 656 | 1.799 19 |
| $n_i$              | 0.365 015 | 1.811 61 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.663 443 96E+00 |
| $A_2$                           | 4.087 085 92E-01 |
| $A_3$                           | 1.221 682 83E+00 |
| $B_1$                           | 7.993 924 12E-03 |
| $B_2$                           | 2.734 257 39E-02 |
| $B_3$                           | 8.491 142 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 1.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 121.9 |
| Rigidity Modulus G (GPa) | 47.2  |
| Poisson's Ratio $\sigma$ | 0.291 |
| Knoop Hardness Hk[Class] | 700 7 |
| Abrasion Aa              | 61    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.012 406 |
| $n_C - n_{A'}$      | 0.005 321 |
| $n_d - n_C$         | 0.004 707 |
| $n_e - n_C$         | 0.008 420 |
| $n_g - n_d$         | 0.019 488 |
| $n_g - n_F$         | 0.008 604 |
| $n_h - n_g$         | 0.007 206 |
| $n_i - n_g$         | 0.019 625 |
| $n_{C'} - n_t$      | 0.013 153 |
| $n_e - n_{C'}$      | 0.007 673 |
| $n_{F'} - n_e$      | 0.008 069 |
| $n_i - n_{F'}$      | 0.027 331 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.795 7 |
| $\theta_{C,A'}$              | 0.341 3 |
| $\theta_{d,C}$               | 0.301 9 |
| $\theta_{e,C}$               | 0.540 1 |
| $\theta_{g,d}$               | 1.250 0 |
| $\theta_{g,F}$               | 0.551 9 |
| $\theta_{h,g}$               | 0.462 2 |
| $\theta_{i,g}$               | 1.258 7 |
| $\theta'_{C,t}$              | 0.835 5 |
| $\theta'_{e,C'}$             | 0.487 4 |
| $\theta'_{F,e}$              | 0.512 6 |
| $\theta'_{i,F'}$             | 1.736 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.016 5  |
| $\Delta\theta_{C,A'}$ | 0.005 4  |
| $\Delta\theta_{g,d}$  | -0.011 8 |
| $\Delta\theta_{g,F}$  | -0.009 4 |
| $\Delta\theta_{i,g}$  | -0.051 4 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 370  | $\lambda_5$      | 305 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 349  | $\lambda_{0.05}$ | 308 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.44 | 0.42             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.10             |
| 320                    | 0.33             |
| 330                    | 0.55             |
| 340                    | 0.71             |
| 350                    | 0.81             |
| 360                    | 0.88             |
| 370                    | 0.930            |
| 380                    | 0.956            |
| 390                    | 0.971            |
| 400                    | 0.979            |
| 420                    | 0.987            |
| 440                    | 0.991            |
| 460                    | 0.994            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.997            |
| 1 400                  | 0.993            |
| 1 600                  | 0.993            |
| 1 800                  | 0.983            |
| 2 000                  | 0.958            |
| 2 200                  | 0.88             |
| 2 400                  | 0.64             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 641   |
| Annealing Point AP (°C)                                          | 660   |
| Transformation Temperature Tg (°C)                               | 686   |
| Yield Point At (°C)                                              | 706   |
| Softening Point SP (°C)                                          | 726   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 61    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 74    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.845 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 49                                             |
| -90 ~ -80                               | 50                                             |
| -80 ~ -70                               | 51                                             |
| -70 ~ -60                               | 52                                             |
| -60 ~ -50                               | 53                                             |
| -50 ~ -40                               | 54                                             |
| -40 ~ -30                               | 55                                             |
| -30 ~ -20                               | 56                                             |
| -20 ~ -10                               | 57                                             |
| -10 ~ 0                                 | 58                                             |
| 0 ~ 10                                  | 59                                             |
| 10 ~ 20                                 | 60                                             |
| 20 ~ 30                                 | 61                                             |
| 30 ~ 40                                 | 62                                             |
| 40 ~ 50                                 | 63                                             |
| 50 ~ 60                                 | 64                                             |
| 60 ~ 70                                 | 65                                             |
| 70 ~ 80                                 | 66                                             |
| 80 ~ 90                                 | 66                                             |
| 90 ~ 100                                | 67                                             |
| 100 ~ 110                               | 68                                             |
| 110 ~ 120                               | 69                                             |
| 120 ~ 130                               | 70                                             |
| 130 ~ 140                               | 70                                             |
| 140 ~ 150                               | 71                                             |
| 150 ~ 160                               | 72                                             |
| 160 ~ 170                               | 72                                             |
| 170 ~ 180                               | 73                                             |
| 180 ~ 190                               | 74                                             |
| 190 ~ 200                               | 74                                             |
| 200 ~ 210                               | 75                                             |
| 210 ~ 220                               | 76                                             |
| 220 ~ 230                               | 76                                             |
| 230 ~ 240                               | 77                                             |
| 240 ~ 250                               | 77                                             |
| 250 ~ 260                               | 78                                             |
| 260 ~ 270                               | 79                                             |
| 270 ~ 280                               | 79                                             |
| 280 ~ 290                               | 80                                             |
| 290 ~ 300                               | 80                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.43 |
| Specific Gravity $d$                                     | 4.23 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.6                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.3 | 3.6 | 3.9 | 3.9 | 4.3 | 4.8 | 5.5 |
| -60 ~ -40                                    | 2.4                                                             | 2.6 | 2.9 | 3.0 | 3.1 | 3.3 | 3.5 | 3.8 | 3.9 | 4.3 | 4.8 | 5.5 |
| -40 ~ -20                                    | 2.4                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.3 | 3.5 | 3.9 | 3.9 | 4.4 | 4.8 | 5.6 |
| -20 ~ 0                                      | 2.5                                                             | 2.7 | 3.0 | 3.2 | 3.2 | 3.5 | 3.7 | 4.0 | 4.1 | 4.5 | 5.0 | 5.9 |
| 0 ~ 20                                       | 2.6                                                             | 2.8 | 3.3 | 3.4 | 3.4 | 3.6 | 3.8 | 4.2 | 4.2 | 4.7 | 5.1 | 6.1 |
| 20 ~ 40                                      | 2.8                                                             | 2.9 | 3.3 | 3.5 | 3.5 | 3.7 | 4.0 | 4.4 | 4.4 | 4.9 | 5.4 | 6.3 |
| 40 ~ 60                                      | 2.9                                                             | 3.1 | 3.5 | 3.7 | 3.7 | 4.0 | 4.2 | 4.6 | 4.6 | 5.1 | 5.6 | 6.5 |
| 60 ~ 80                                      | 3.1                                                             | 3.3 | 3.7 | 3.8 | 3.9 | 4.1 | 4.3 | 4.7 | 4.8 | 5.3 | 5.9 | 6.8 |
| 80 ~ 100                                     | 3.1                                                             | 3.4 | 3.9 | 4.0 | 4.1 | 4.3 | 4.5 | 4.9 | 5.0 | 5.5 | 6.0 | 7.0 |
| 100 ~ 120                                    | 3.2                                                             | 3.5 | 4.0 | 4.2 | 4.2 | 4.4 | 4.7 | 5.1 | 5.2 | 5.7 | 6.3 | 7.3 |
| 120 ~ 140                                    | 3.3                                                             | 3.7 | 4.1 | 4.3 | 4.3 | 4.5 | 4.8 | 5.3 | 5.3 | 5.9 | 6.4 | 7.5 |
| 140 ~ 160                                    | 3.5                                                             | 3.7 | 4.2 | 4.4 | 4.4 | 4.6 | 4.9 | 5.4 | 5.4 | 6.0 | 6.6 | 7.6 |
| 160 ~ 180                                    | 3.5                                                             | 3.8 | 4.2 | 4.4 | 4.4 | 4.7 | 4.9 | 5.4 | 5.5 | 6.1 | 6.7 | 7.9 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.850 26<br>1.850 259 | Abbe Number $\nu_d$ | 32.27 | Dispersion $n_F - n_C$       | 0.026 349 |
| Refractive Index $n_e$ | 1.856 493             | Abbe Number $\nu_e$ | 32.03 | Dispersion $n_{F'} - n_{C'}$ | 0.026 744 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.800 95 |
| $n_{1970}$         | 1.970 09  | 1.806 85 |
| $n_{1530}$         | 1.529 58  | 1.813 80 |
| $n_{1129}$         | 1.128 64  | 1.821 33 |
| $n_t$              | 1.013 98  | 1.824 29 |
| $n_s$              | 0.852 11  | 1.830 04 |
| $n_{A'}$           | 0.768 19  | 1.834 30 |
| $n_F$              | 0.706 52  | 1.838 38 |
| $n_C$              | 0.656 27  | 1.842 59 |
| $n_{C'}$           | 0.643 85  | 1.843 78 |
| $n_{He-Ne}$        | 0.632 8   | 1.844 91 |
| $n_D$              | 0.589 29  | 1.850 03 |
| $n_d$              | 0.587 56  | 1.850 26 |
| $n_e$              | 0.546 07  | 1.856 49 |
| $n_F$              | 0.486 13  | 1.868 93 |
| $n_{F'}$           | 0.479 99  | 1.870 53 |
| $n_{He-Cd}$        | 0.441 57  | 1.882 43 |
| $n_g$              | 0.435 835 | 1.884 56 |
| $n_h$              | 0.404 656 | 1.898 27 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.982 800 31E+00 |
| $A_2$                           | 3.167 584 50E-01 |
| $A_3$                           | 2.444 726 46E+00 |
| $B_1$                           | 1.189 874 59E-02 |
| $B_2$                           | 5.271 560 01E-02 |
| $B_3$                           | 2.132 206 97E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 2.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 110.0 |
| Rigidity Modulus G (GPa) | 42.9  |
| Poisson's Ratio $\sigma$ | 0.281 |
| Knoop Hardness Hk[Class] | 590 6 |
| Abrasion Aa              | 136   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.018 292 |
| $n_C - n_{A'}$      | 0.008 288 |
| $n_d - n_C$         | 0.007 673 |
| $n_e - n_C$         | 0.013 907 |
| $n_g - n_d$         | 0.034 299 |
| $n_g - n_F$         | 0.015 623 |
| $n_h - n_g$         | 0.013 716 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.019 490 |
| $n_e - n_{C'}$      | 0.012 709 |
| $n_{F'} - n_e$      | 0.014 035 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.694 2 |
| $\theta_{C,A'}$              | 0.314 5 |
| $\theta_{d,C}$               | 0.291 2 |
| $\theta_{e,C}$               | 0.527 8 |
| $\theta_{g,d}$               | 1.301 7 |
| $\theta_{g,F}$               | 0.592 9 |
| $\theta_{h,g}$               | 0.520 6 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.728 8 |
| $\theta'_{e,C'}$             | 0.475 2 |
| $\theta'_{F',e}$             | 0.524 8 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.003 9 |
| $\Delta\theta_{C,A'}$ | -0.000 5 |
| $\Delta\theta_{g,d}$  | 0.004 0  |
| $\Delta\theta_{g,F}$  | 0.003 6  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 370 |
| $\lambda_{70}$        | 425  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 417  | $\lambda_{0.05}$ | 364 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 6.64 | 6.89             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.01             |
| 370                    | 0.11             |
| 380                    | 0.29             |
| 390                    | 0.49             |
| 400                    | 0.65             |
| 420                    | 0.83             |
| 440                    | 0.913            |
| 460                    | 0.945            |
| 480                    | 0.963            |
| 500                    | 0.976            |
| 550                    | 0.992            |
| 600                    | 0.995            |
| 650                    | 0.995            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.998            |
| 1 800                  | 0.993            |
| 2 000                  | 0.989            |
| 2 200                  | 0.982            |
| 2 400                  | 0.959            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 656   |
| Annealing Point AP (°C)                                          | 685   |
| Transformation Temperature Tg (°C)                               | 704   |
| Yield Point At (°C)                                              | 753   |
| Softening Point SP (°C)                                          | 802   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 78    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 93    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.874 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 63                                             |
| -90 ~ -80                               | 64                                             |
| -80 ~ -70                               | 66                                             |
| -70 ~ -60                               | 67                                             |
| -60 ~ -50                               | 68                                             |
| -50 ~ -40                               | 70                                             |
| -40 ~ -30                               | 71                                             |
| -30 ~ -20                               | 72                                             |
| -20 ~ -10                               | 74                                             |
| -10 ~ 0                                 | 75                                             |
| 0 ~ 10                                  | 76                                             |
| 10 ~ 20                                 | 77                                             |
| 20 ~ 30                                 | 78                                             |
| 30 ~ 40                                 | 79                                             |
| 40 ~ 50                                 | 80                                             |
| 50 ~ 60                                 | 81                                             |
| 60 ~ 70                                 | 83                                             |
| 70 ~ 80                                 | 84                                             |
| 80 ~ 90                                 | 84                                             |
| 90 ~ 100                                | 85                                             |
| 100 ~ 110                               | 86                                             |
| 110 ~ 120                               | 87                                             |
| 120 ~ 130                               | 88                                             |
| 130 ~ 140                               | 89                                             |
| 140 ~ 150                               | 90                                             |
| 150 ~ 160                               | 91                                             |
| 160 ~ 170                               | 91                                             |
| 170 ~ 180                               | 92                                             |
| 180 ~ 190                               | 93                                             |
| 190 ~ 200                               | 93                                             |
| 200 ~ 210                               | 94                                             |
| 210 ~ 220                               | 95                                             |
| 220 ~ 230                               | 95                                             |
| 230 ~ 240                               | 96                                             |
| 240 ~ 250                               | 96                                             |
| 250 ~ 260                               | 97                                             |
| 260 ~ 270                               | 97                                             |
| 270 ~ 280                               | 98                                             |
| 280 ~ 290                               | 98                                             |
| 290 ~ 300                               | 99                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.52 |
| Specific Gravity $d$                                      | 4.36 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | 0.5                                                             | 0.8 | 1.4 | 1.6 | 1.7 | 2.0 | 2.4 | 3.3 | 3.4 | 4.5 | 5.8 | - |
| -60 ~ -40                                    | 0.5                                                             | 0.8 | 1.5 | 1.7 | 1.8 | 2.1 | 2.5 | 3.3 | 3.4 | 4.6 | 5.9 | - |
| -40 ~ -20                                    | 0.6                                                             | 1.0 | 1.6 | 1.8 | 1.9 | 2.2 | 2.6 | 3.6 | 3.7 | 4.8 | 6.1 | - |
| -20 ~ 0                                      | 0.8                                                             | 1.1 | 1.7 | 1.9 | 2.0 | 2.4 | 2.9 | 3.7 | 3.9 | 5.0 | 6.4 | - |
| 0 ~ 20                                       | 0.9                                                             | 1.2 | 1.9 | 2.1 | 2.2 | 2.6 | 3.1 | 4.0 | 4.1 | 5.3 | 6.7 | - |
| 20 ~ 40                                      | 1.1                                                             | 1.4 | 2.1 | 2.3 | 2.4 | 2.8 | 3.2 | 4.2 | 4.3 | 5.7 | 7.1 | - |
| 40 ~ 60                                      | 1.2                                                             | 1.6 | 2.3 | 2.5 | 2.6 | 3.0 | 3.4 | 4.4 | 4.5 | 5.9 | 7.4 | - |
| 60 ~ 80                                      | 1.3                                                             | 1.7 | 2.5 | 2.7 | 2.7 | 3.2 | 3.7 | 4.7 | 4.8 | 6.1 | 7.7 | - |
| 80 ~ 100                                     | 1.5                                                             | 1.8 | 2.5 | 2.8 | 2.9 | 3.3 | 3.8 | 4.8 | 5.0 | 6.4 | 7.9 | - |
| 100 ~ 120                                    | 1.5                                                             | 1.9 | 2.6 | 2.9 | 3.0 | 3.4 | 3.9 | 4.9 | 5.1 | 6.5 | 8.2 | - |
| 120 ~ 140                                    | 1.6                                                             | 1.9 | 2.7 | 3.0 | 3.0 | 3.5 | 4.0 | 5.0 | 5.2 | 6.6 | 8.3 | - |
| 140 ~ 160                                    | 1.5                                                             | 1.9 | 2.7 | 3.0 | 3.0 | 3.5 | 4.0 | 5.2 | 5.2 | 6.8 | 8.4 | - |
| 160 ~ 180                                    | 1.4                                                             | 1.8 | 2.6 | 3.0 | 3.1 | 3.6 | 4.1 | 5.2 | 5.3 | 6.8 | 8.5 | - |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 2.003 30<br>2.003 300 | Abbe Number $\nu_d$ | 28.27 | Dispersion $n_F - n_C$       | 0.035 486 |
| Refractive Index $n_e$ | 2.011 689             | Abbe Number $\nu_e$ | 28.07 | Dispersion $n_{F'} - n_{C'}$ | 0.036 041 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.939 04 |
| $n_{1970}$         | 1.970 09  | 1.946 42 |
| $n_{1530}$         | 1.529 58  | 1.955 18 |
| $n_{1129}$         | 1.128 64  | 1.964 86 |
| $n_t$              | 1.013 98  | 1.968 73 |
| $n_s$              | 0.852 11  | 1.976 30 |
| $n_{A'}$           | 0.768 19  | 1.981 95 |
| $n_F$              | 0.706 52  | 1.987 39 |
| $n_C$              | 0.656 27  | 1.993 01 |
| $n_{C'}$           | 0.643 85  | 1.994 61 |
| $n_{He-Ne}$        | 0.632 8   | 1.996 13 |
| $n_D$              | 0.589 29  | 2.002 99 |
| $n_d$              | 0.587 56  | 2.003 30 |
| $n_e$              | 0.546 07  | 2.011 69 |
| $n_F$              | 0.486 13  | 2.028 50 |
| $n_{F'}$           | 0.479 99  | 2.030 66 |
| $n_{He-Cd}$        | 0.441 57  | 2.046 82 |
| $n_g$              | 0.435 835 | 2.049 72 |
| $n_h$              | 0.404 656 | 2.068 44 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.325 571 48E+00 |
| $A_2$                           | 5.079 671 33E-01 |
| $A_3$                           | 2.430 871 98E+00 |
| $B_1$                           | 1.328 952 08E-02 |
| $B_2$                           | 5.283 354 49E-02 |
| $B_3$                           | 1.611 224 08E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 125.5 |
| Rigidity Modulus G (GPa) | 48.4  |
| Poisson's Ratio $\sigma$ | 0.297 |
| Knoop Hardness Hk[Class] | 700 7 |
| Abrasion Aa              | 63    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.024 281 |
| $n_C - n_{A'}$      | 0.011 059 |
| $n_d - n_C$         | 0.010 289 |
| $n_e - n_C$         | 0.018 678 |
| $n_g - n_d$         | 0.046 416 |
| $n_g - n_F$         | 0.021 219 |
| $n_h - n_g$         | 0.018 725 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.025 885 |
| $n_e - n_{C'}$      | 0.017 074 |
| $n_{F'} - n_e$      | 0.018 967 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.684 2 |
| $\theta_{C,A'}$              | 0.311 6 |
| $\theta_{d,C}$               | 0.289 9 |
| $\theta_{e,C}$               | 0.526 3 |
| $\theta_{g,d}$               | 1.308 0 |
| $\theta_{g,F}$               | 0.598 0 |
| $\theta_{h,g}$               | 0.527 7 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.718 2 |
| $\theta'_{e,C'}$             | 0.473 7 |
| $\theta'_{F,e}$              | 0.526 3 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.004 9 |
| $\Delta\theta_{C,A'}$ | 0.001 5 |
| $\Delta\theta_{g,d}$  | 0.002 0 |
| $\Delta\theta_{g,F}$  | 0.002 3 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |       |                  |     |
|-----------------------|-------|------------------|-----|
| $\lambda_{80}$        |       | $\lambda_5$      | 370 |
| $\lambda_{70}$        | 460   |                  |     |
|                       |       |                  |     |
| Internal transmission |       |                  |     |
| $\lambda_{0.80}$      | 435   | $\lambda_{0.05}$ | 371 |
|                       |       |                  |     |
| CCI                   |       |                  |     |
| B                     | G     | R                |     |
| 0.00                  | 10.86 | 11.57            |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.03             |
| 380                    | 0.16             |
| 390                    | 0.33             |
| 400                    | 0.50             |
| 420                    | 0.72             |
| 440                    | 0.83             |
| 460                    | 0.88             |
| 480                    | 0.921            |
| 500                    | 0.945            |
| 550                    | 0.979            |
| 600                    | 0.988            |
| 650                    | 0.991            |
| 700                    | 0.993            |
| 800                    | 0.996            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.998            |
| 1 400                  | 0.998            |
| 1 600                  | 0.997            |
| 1 800                  | 0.994            |
| 2 000                  | 0.986            |
| 2 200                  | 0.966            |
| 2 400                  | 0.89             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 702   |
| Yield Point At (°C)                                              | 734   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 60    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 72    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.957 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 47                                             |
| -90 ~ -80                               | 49                                             |
| -80 ~ -70                               | 50                                             |
| -70 ~ -60                               | 51                                             |
| -60 ~ -50                               | 52                                             |
| -50 ~ -40                               | 53                                             |
| -40 ~ -30                               | 54                                             |
| -30 ~ -20                               | 55                                             |
| -20 ~ -10                               | 56                                             |
| -10 ~ 0                                 | 57                                             |
| 0 ~ 10                                  | 58                                             |
| 10 ~ 20                                 | 59                                             |
| 20 ~ 30                                 | 60                                             |
| 30 ~ 40                                 | 61                                             |
| 40 ~ 50                                 | 62                                             |
| 50 ~ 60                                 | 63                                             |
| 60 ~ 70                                 | 64                                             |
| 70 ~ 80                                 | 64                                             |
| 80 ~ 90                                 | 65                                             |
| 90 ~ 100                                | 66                                             |
| 100 ~ 110                               | 67                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 69                                             |
| 140 ~ 150                               | 69                                             |
| 150 ~ 160                               | 70                                             |
| 160 ~ 170                               | 70                                             |
| 170 ~ 180                               | 71                                             |
| 180 ~ 190                               | 71                                             |
| 190 ~ 200                               | 72                                             |
| 200 ~ 210                               | 72                                             |
| 210 ~ 220                               | 73                                             |
| 220 ~ 230                               | 73                                             |
| 230 ~ 240                               | 74                                             |
| 240 ~ 250                               | 74                                             |
| 250 ~ 260                               | 74                                             |
| 260 ~ 270                               | 74                                             |
| 270 ~ 280                               | 75                                             |
| 280 ~ 290                               | 75                                             |
| 290 ~ 300                               | 75                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.89 |
| Specific Gravity $d$                                     | 5.23 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |      |      |      |      |      |      |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|------|------|------|------|------|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |      |      |      |      |      |      |   |
|                                              | 1550                                                            | t   | r   | C   | C'   | d    | e    | F    | F'   | g    | i |
| -80 ~ -60                                    | 5.1                                                             | 5.5 | 6.3 | 6.7 | 6.8  | 7.3  | 7.7  | 8.9  | 9.1  | 10.5 | - |
| -60 ~ -40                                    | 5.0                                                             | 5.4 | 6.4 | 6.7 | 6.8  | 7.3  | 7.8  | 9.1  | 9.2  | 10.9 | - |
| -40 ~ -20                                    | 5.1                                                             | 5.5 | 6.6 | 6.9 | 7.0  | 7.5  | 8.1  | 9.4  | 9.6  | 11.2 | - |
| -20 ~ 0                                      | 5.2                                                             | 5.8 | 6.8 | 7.1 | 7.2  | 7.8  | 8.4  | 9.8  | 10.0 | 11.7 | - |
| 0 ~ 20                                       | 5.4                                                             | 5.9 | 7.1 | 7.4 | 7.5  | 8.1  | 8.8  | 10.2 | 10.3 | 12.2 | - |
| 20 ~ 40                                      | 5.7                                                             | 6.2 | 7.3 | 7.7 | 7.8  | 8.5  | 9.2  | 10.7 | 10.9 | 12.7 | - |
| 40 ~ 60                                      | 5.9                                                             | 6.5 | 7.6 | 8.0 | 8.2  | 8.8  | 9.5  | 11.1 | 11.4 | 13.3 | - |
| 60 ~ 80                                      | 6.1                                                             | 6.7 | 8.0 | 8.4 | 8.5  | 9.3  | 10.0 | 11.6 | 11.8 | 13.9 | - |
| 80 ~ 100                                     | 6.4                                                             | 7.0 | 8.3 | 8.7 | 8.8  | 9.6  | 10.3 | 12.0 | 12.2 | 14.5 | - |
| 100 ~ 120                                    | 6.6                                                             | 7.3 | 8.6 | 9.0 | 9.2  | 9.9  | 10.7 | 12.5 | 12.7 | 15.0 | - |
| 120 ~ 140                                    | 6.7                                                             | 7.5 | 8.9 | 9.3 | 9.5  | 10.3 | 11.1 | 12.9 | 13.1 | 15.5 | - |
| 140 ~ 160                                    | 7.0                                                             | 7.7 | 9.1 | 9.6 | 9.8  | 10.6 | 11.4 | 13.3 | 13.6 | 16.0 | - |
| 160 ~ 180                                    | 7.1                                                             | 7.8 | 9.3 | 9.8 | 10.0 | 10.8 | 11.7 | 13.6 | 13.9 | 16.5 | - |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.916 50<br>1.916 500 | Abbe Number $\nu_d$ | 31.60 | Dispersion $n_F - n_C$       | 0.028 999 |
| Refractive Index $n_e$ | 1.923 361             | Abbe Number $\nu_e$ | 31.38 | Dispersion $n_{F'} - n_{C'}$ | 0.029 426 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.858 14 |
| $n_{1970}$         | 1.970 09  | 1.866 07 |
| $n_{1530}$         | 1.529 58  | 1.875 03 |
| $n_{1129}$         | 1.128 64  | 1.884 13 |
| $n_t$              | 1.013 98  | 1.887 56 |
| $n_s$              | 0.852 11  | 1.894 08 |
| $n_{A'}$           | 0.768 19  | 1.898 84 |
| $n_F$              | 0.706 52  | 1.903 38 |
| $n_C$              | 0.656 27  | 1.908 03 |
| $n_{C'}$           | 0.643 85  | 1.909 36 |
| $n_{He-Ne}$        | 0.632 8   | 1.910 60 |
| $n_D$              | 0.589 29  | 1.916 25 |
| $n_d$              | 0.587 56  | 1.916 50 |
| $n_e$              | 0.546 07  | 1.923 36 |
| $n_F$              | 0.486 13  | 1.937 03 |
| $n_{F'}$           | 0.479 99  | 1.938 78 |
| $n_{He-Cd}$        | 0.441 57  | 1.951 85 |
| $n_g$              | 0.435 835 | 1.954 18 |
| $n_h$              | 0.404 656 | 1.969 20 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.128 443 40E+00 |
| $A_2$                           | 4.050 821 39E-01 |
| $A_3$                           | 1.679 184 61E+00 |
| $B_1$                           | 1.173 098 15E-02 |
| $B_2$                           | 5.087 065 99E-02 |
| $B_3$                           | 1.070 914 56E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 2   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 3,2 |
| Phosphate Resistance PR                   | 1,1 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 113.5 |
| Rigidity Modulus G (GPa) | 45.7  |
| Poisson's Ratio $\sigma$ | 0.242 |
| Knoop Hardness Hk[Class] | 670 7 |
| Abrasion Aa              | 69    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.020 471 |
| $n_C - n_{A'}$      | 0.009 192 |
| $n_d - n_C$         | 0.008 465 |
| $n_e - n_C$         | 0.015 326 |
| $n_g - n_d$         | 0.037 676 |
| $n_g - n_F$         | 0.017 142 |
| $n_h - n_g$         | 0.015 029 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.021 794 |
| $n_e - n_{C'}$      | 0.014 003 |
| $n_{F'} - n_e$      | 0.015 423 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.705 9 |
| $\theta_{C,A'}$              | 0.317 0 |
| $\theta_{d,C}$               | 0.291 9 |
| $\theta_{e,C}$               | 0.528 5 |
| $\theta_{g,d}$               | 1.299 2 |
| $\theta_{g,F}$               | 0.591 1 |
| $\theta_{h,g}$               | 0.518 3 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.740 6 |
| $\theta'_{e,C'}$             | 0.475 9 |
| $\theta'_{F,e}$              | 0.524 1 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.011 0 |
| $\Delta\theta_{C,A'}$ | 0.002 9 |
| $\Delta\theta_{g,d}$  | 0.000 1 |
| $\Delta\theta_{g,F}$  | 0.000 8 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 355 |
| $\lambda_{70}$        | 400  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 389  | $\lambda_{0.05}$ | 353 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.51 | 2.67             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.01             |
| 360                    | 0.16             |
| 370                    | 0.45             |
| 380                    | 0.68             |
| 390                    | 0.81             |
| 400                    | 0.87             |
| 420                    | 0.936            |
| 440                    | 0.961            |
| 460                    | 0.973            |
| 480                    | 0.981            |
| 500                    | 0.987            |
| 550                    | 0.994            |
| 600                    | 0.996            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.995            |
| 1 600                  | 0.994            |
| 1 800                  | 0.985            |
| 2 000                  | 0.963            |
| 2 200                  | 0.89             |
| 2 400                  | 0.71             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 581   |
| Annealing Point AP (°C)                                          | 601   |
| Transformation Temperature Tg (°C)                               | 625   |
| Yield Point At (°C)                                              | 658   |
| Softening Point SP (°C)                                          | 677   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 59    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 72    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.894 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 46                                             |
| -90 ~ -80                               | 47                                             |
| -80 ~ -70                               | 48                                             |
| -70 ~ -60                               | 50                                             |
| -60 ~ -50                               | 51                                             |
| -50 ~ -40                               | 52                                             |
| -40 ~ -30                               | 53                                             |
| -30 ~ -20                               | 54                                             |
| -20 ~ -10                               | 55                                             |
| -10 ~ 0                                 | 56                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 60                                             |
| 40 ~ 50                                 | 61                                             |
| 50 ~ 60                                 | 62                                             |
| 60 ~ 70                                 | 63                                             |
| 70 ~ 80                                 | 64                                             |
| 80 ~ 90                                 | 65                                             |
| 90 ~ 100                                | 66                                             |
| 100 ~ 110                               | 66                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 69                                             |
| 140 ~ 150                               | 69                                             |
| 150 ~ 160                               | 70                                             |
| 160 ~ 170                               | 71                                             |
| 170 ~ 180                               | 71                                             |
| 180 ~ 190                               | 72                                             |
| 190 ~ 200                               | 72                                             |
| 200 ~ 210                               | 73                                             |
| 210 ~ 220                               | 74                                             |
| 220 ~ 230                               | 74                                             |
| 230 ~ 240                               | 75                                             |
| 240 ~ 250                               | 75                                             |
| 250 ~ 260                               | 75                                             |
| 260 ~ 270                               | 76                                             |
| 270 ~ 280                               | 76                                             |
| 280 ~ 290                               | 77                                             |
| 290 ~ 300                               | 77                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.90 |
| Specific Gravity $d$                                      | 4.74 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |      |      |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |      |      |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g    | h    | i |
| -80 ~ -60                                    | 3.7                                                             | 4.0 | 4.6 | 4.8 | 4.9 | 5.2 | 5.7 | 6.5 | 6.6 | 7.8  | 9.1  | - |
| -60 ~ -40                                    | 3.7                                                             | 4.0 | 4.7 | 4.9 | 5.0 | 5.4 | 5.8 | 6.6 | 6.8 | 8.0  | 9.3  | - |
| -40 ~ -20                                    | 3.8                                                             | 4.1 | 4.9 | 5.1 | 5.2 | 5.5 | 5.9 | 7.0 | 7.1 | 8.3  | 9.7  | - |
| -20 ~ 0                                      | 3.9                                                             | 4.4 | 5.1 | 5.3 | 5.4 | 5.8 | 6.2 | 7.3 | 7.4 | 8.7  | 10.2 | - |
| 0 ~ 20                                       | 4.1                                                             | 4.6 | 5.3 | 5.6 | 5.6 | 6.1 | 6.5 | 7.5 | 7.7 | 9.1  | 10.7 | - |
| 20 ~ 40                                      | 4.4                                                             | 4.7 | 5.5 | 5.9 | 5.9 | 6.4 | 6.8 | 7.9 | 8.0 | 9.4  | 11.2 | - |
| 40 ~ 60                                      | 4.5                                                             | 4.9 | 5.8 | 6.1 | 6.2 | 6.7 | 7.1 | 8.2 | 8.4 | 9.9  | 11.6 | - |
| 60 ~ 80                                      | 4.8                                                             | 5.2 | 6.0 | 6.3 | 6.4 | 6.9 | 7.4 | 8.5 | 8.7 | 10.2 | 12.1 | - |
| 80 ~ 100                                     | 4.8                                                             | 5.3 | 6.2 | 6.5 | 6.6 | 7.1 | 7.7 | 8.9 | 9.0 | 10.6 | 12.5 | - |
| 100 ~ 120                                    | 5.0                                                             | 5.4 | 6.3 | 6.6 | 6.7 | 7.2 | 7.9 | 9.1 | 9.3 | 11.0 | 12.9 | - |
| 120 ~ 140                                    | 5.0                                                             | 5.5 | 6.4 | 6.8 | 6.9 | 7.4 | 8.0 | 9.4 | 9.5 | 11.3 | 13.2 | - |
| 140 ~ 160                                    | 5.1                                                             | 5.5 | 6.5 | 6.8 | 6.9 | 7.6 | 8.2 | 9.5 | 9.7 | 11.5 | 13.5 | - |
| 160 ~ 180                                    | 5.1                                                             | 5.6 | 6.6 | 7.0 | 7.1 | 7.7 | 8.3 | 9.6 | 9.8 | 11.7 | 13.8 | - |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.851 50<br>1.851 500 | Abbe Number $\nu_d$ | 40.78 | Dispersion $n_F - n_C$       | 0.020 880 |
| Refractive Index $n_e$ | 1.856 460             | Abbe Number $\nu_e$ | 40.53 | Dispersion $n_{F'} - n_{C'}$ | 0.021 134 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.805 61 |
| $n_{1970}$         | 1.970 09  | 1.812 33 |
| $n_{1530}$         | 1.529 58  | 1.819 83 |
| $n_{1129}$         | 1.128 64  | 1.827 18 |
| $n_t$              | 1.013 98  | 1.829 87 |
| $n_s$              | 0.852 11  | 1.834 87 |
| $n_{A'}$           | 0.768 19  | 1.838 47 |
| $n_F$              | 0.706 52  | 1.841 86 |
| $n_C$              | 0.656 27  | 1.845 30 |
| $n_{C'}$           | 0.643 85  | 1.846 28 |
| $n_{He-Ne}$        | 0.632 8   | 1.847 19 |
| $n_D$              | 0.589 29  | 1.851 32 |
| $n_d$              | 0.587 56  | 1.851 50 |
| $n_e$              | 0.546 07  | 1.856 46 |
| $n_F$              | 0.486 13  | 1.866 18 |
| $n_{F'}$           | 0.479 99  | 1.867 41 |
| $n_{He-Cd}$        | 0.441 57  | 1.876 48 |
| $n_g$              | 0.435 835 | 1.878 07 |
| $n_h$              | 0.404 656 | 1.888 22 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.951 188 27E+00 |
| $A_2$                           | 3.776 072 23E-01 |
| $A_3$                           | 1.477 572 62E+00 |
| $B_1$                           | 9.765 607 99E-03 |
| $B_2$                           | 3.822 320 43E-02 |
| $B_3$                           | 1.122 367 20E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 2   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 120.8 |
| Rigidity Modulus G (GPa) | 46.3  |
| Poisson's Ratio $\sigma$ | 0.303 |
| Knoop Hardness Hk[Class] | 690 7 |
| Abrasion Aa              | 68    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.015 434 |
| $n_C - n_{A'}$      | 0.006 834 |
| $n_d - n_C$         | 0.006 196 |
| $n_e - n_C$         | 0.011 156 |
| $n_g - n_d$         | 0.026 575 |
| $n_g - n_F$         | 0.011 891 |
| $n_h - n_g$         | 0.010 143 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.016 409 |
| $n_e - n_{C'}$      | 0.010 181 |
| $n_{F'} - n_e$      | 0.010 953 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.739 2 |
| $\theta_{C,A'}$              | 0.327 3 |
| $\theta_{d,C}$               | 0.296 7 |
| $\theta_{e,C}$               | 0.534 3 |
| $\theta_{g,d}$               | 1.272 7 |
| $\theta_{g,F}$               | 0.569 5 |
| $\theta_{h,g}$               | 0.485 8 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.776 4 |
| $\theta'_{e,C'}$             | 0.481 7 |
| $\theta'_{F',e}$             | 0.518 3 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.001 2  |
| $\Delta\theta_{C,A'}$ | 0.002 0  |
| $\Delta\theta_{g,d}$  | -0.007 3 |
| $\Delta\theta_{g,F}$  | -0.006 0 |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 340 |
| $\lambda_{70}$        | 380  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 376  | $\lambda_{0.05}$ | 339 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.47 | 1.52             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.07             |
| 350                    | 0.31             |
| 360                    | 0.57             |
| 370                    | 0.74             |
| 380                    | 0.84             |
| 390                    | 0.89             |
| 400                    | 0.930            |
| 420                    | 0.962            |
| 440                    | 0.975            |
| 460                    | 0.983            |
| 480                    | 0.989            |
| 500                    | 0.993            |
| 550                    | 0.998            |
| 600                    | 0.999            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.997            |
| 1 800                  | 0.992            |
| 2 000                  | 0.975            |
| 2 200                  | 0.938            |
| 2 400                  | 0.78             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 634   |
| Annealing Point AP (°C)                                          | 660   |
| Transformation Temperature Tg (°C)                               | 680   |
| Yield Point At (°C)                                              | 717   |
| Softening Point SP (°C)                                          | 743   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 68    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 81    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.861 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 55                                             |
| -90 ~ -80                               | 56                                             |
| -80 ~ -70                               | 57                                             |
| -70 ~ -60                               | 58                                             |
| -60 ~ -50                               | 60                                             |
| -50 ~ -40                               | 61                                             |
| -40 ~ -30                               | 62                                             |
| -30 ~ -20                               | 63                                             |
| -20 ~ -10                               | 64                                             |
| -10 ~ 0                                 | 65                                             |
| 0 ~ 10                                  | 66                                             |
| 10 ~ 20                                 | 67                                             |
| 20 ~ 30                                 | 68                                             |
| 30 ~ 40                                 | 69                                             |
| 40 ~ 50                                 | 70                                             |
| 50 ~ 60                                 | 71                                             |
| 60 ~ 70                                 | 72                                             |
| 70 ~ 80                                 | 73                                             |
| 80 ~ 90                                 | 74                                             |
| 90 ~ 100                                | 75                                             |
| 100 ~ 110                               | 76                                             |
| 110 ~ 120                               | 76                                             |
| 120 ~ 130                               | 77                                             |
| 130 ~ 140                               | 78                                             |
| 140 ~ 150                               | 78                                             |
| 150 ~ 160                               | 79                                             |
| 160 ~ 170                               | 80                                             |
| 170 ~ 180                               | 80                                             |
| 180 ~ 190                               | 81                                             |
| 190 ~ 200                               | 82                                             |
| 200 ~ 210                               | 82                                             |
| 210 ~ 220                               | 83                                             |
| 220 ~ 230                               | 83                                             |
| 230 ~ 240                               | 84                                             |
| 240 ~ 250                               | 84                                             |
| 250 ~ 260                               | 85                                             |
| 260 ~ 270                               | 85                                             |
| 270 ~ 280                               | 85                                             |
| 280 ~ 290                               | 86                                             |
| 290 ~ 300                               | 86                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.27 |
| Specific Gravity $d$                                     | 4.70 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | 2.8                                                             | 3.0 | 3.5 | 3.7 | 3.8 | 4.0 | 4.3 | 4.9 | 5.0 | 5.7 | 6.6 | - |
| -60 ~ -40                                    | 2.7                                                             | 2.9 | 3.5 | 3.7 | 3.7 | 4.0 | 4.3 | 4.9 | 5.0 | 5.8 | 6.6 | - |
| -40 ~ -20                                    | 2.7                                                             | 3.0 | 3.5 | 3.7 | 3.8 | 4.1 | 4.3 | 5.1 | 5.1 | 5.9 | 6.7 | - |
| -20 ~ 0                                      | 2.8                                                             | 3.1 | 3.6 | 3.8 | 3.9 | 4.2 | 4.6 | 5.2 | 5.3 | 6.1 | 6.9 | - |
| 0 ~ 20                                       | 2.9                                                             | 3.2 | 3.8 | 4.0 | 4.0 | 4.4 | 4.7 | 5.4 | 5.5 | 6.3 | 7.2 | - |
| 20 ~ 40                                      | 3.1                                                             | 3.4 | 4.0 | 4.2 | 4.2 | 4.6 | 4.9 | 5.6 | 5.7 | 6.6 | 7.6 | - |
| 40 ~ 60                                      | 3.3                                                             | 3.6 | 4.2 | 4.4 | 4.4 | 4.8 | 5.1 | 5.8 | 5.9 | 6.9 | 7.9 | - |
| 60 ~ 80                                      | 3.4                                                             | 3.7 | 4.4 | 4.5 | 4.6 | 5.0 | 5.4 | 6.1 | 6.2 | 7.1 | 8.1 | - |
| 80 ~ 100                                     | 3.5                                                             | 3.9 | 4.5 | 4.7 | 4.8 | 5.2 | 5.5 | 6.3 | 6.4 | 7.4 | 8.4 | - |
| 100 ~ 120                                    | 3.7                                                             | 4.0 | 4.7 | 4.9 | 5.0 | 5.3 | 5.7 | 6.5 | 6.6 | 7.6 | 8.6 | - |
| 120 ~ 140                                    | 3.8                                                             | 4.1 | 4.8 | 5.0 | 5.1 | 5.5 | 5.9 | 6.7 | 6.8 | 7.8 | 8.9 | - |
| 140 ~ 160                                    | 3.8                                                             | 4.2 | 4.9 | 5.1 | 5.2 | 5.6 | 6.0 | 6.8 | 6.9 | 8.0 | 9.2 | - |
| 160 ~ 180                                    | 3.8                                                             | 4.2 | 4.9 | 5.3 | 5.3 | 5.7 | 6.1 | 7.0 | 7.1 | 8.2 | 9.3 | - |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.891 90<br>1.891 900 | Abbe Number $\nu_d$ | 37.13 | Dispersion $n_F - n_C$       | 0.024 019 |
| Refractive Index $n_e$ | 1.897 597             | Abbe Number $\nu_e$ | 36.88 | Dispersion $n_{F'} - n_{C'}$ | 0.024 337 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.842 59 |
| $n_{1970}$         | 1.970 09  | 1.849 27 |
| $n_{1530}$         | 1.529 58  | 1.856 86 |
| $n_{1129}$         | 1.128 64  | 1.864 60 |
| $n_t$              | 1.013 98  | 1.867 52 |
| $n_s$              | 0.852 11  | 1.873 05 |
| $n_{A'}$           | 0.768 19  | 1.877 09 |
| $n_F$              | 0.706 52  | 1.880 91 |
| $n_C$              | 0.656 27  | 1.884 82 |
| $n_{C'}$           | 0.643 85  | 1.885 93 |
| $n_{He-Ne}$        | 0.632 8   | 1.886 98 |
| $n_D$              | 0.589 29  | 1.891 69 |
| $n_d$              | 0.587 56  | 1.891 90 |
| $n_e$              | 0.546 07  | 1.897 60 |
| $n_F$              | 0.486 13  | 1.908 84 |
| $n_{F'}$           | 0.479 99  | 1.910 27 |
| $n_{He-Cd}$        | 0.441 57  | 1.920 85 |
| $n_g$              | 0.435 835 | 1.922 73 |
| $n_h$              | 0.404 656 | 1.934 69 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.104 403 11E+00 |
| $A_2$                           | 3.583 461 61E-01 |
| $A_3$                           | 1.630 100 64E+00 |
| $B_1$                           | 1.085 318 11E-02 |
| $B_2$                           | 4.434 059 20E-02 |
| $B_3$                           | 1.232 498 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 123.0 |
| Rigidity Modulus G (GPa) | 47.1  |
| Poisson's Ratio $\sigma$ | 0.306 |
| Knoop Hardness Hk[Class] | 700 7 |
| Abrasion Aa              | 63    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.017 302 |
| $n_C - n_{A'}$      | 0.007 739 |
| $n_d - n_C$         | 0.007 076 |
| $n_e - n_C$         | 0.012 773 |
| $n_g - n_d$         | 0.030 827 |
| $n_g - n_F$         | 0.013 884 |
| $n_h - n_g$         | 0.011 965 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.018 412 |
| $n_e - n_{C'}$      | 0.011 663 |
| $n_{F'} - n_e$      | 0.012 674 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.720 3 |
| $\theta_{C,A'}$              | 0.322 2 |
| $\theta_{d,C}$               | 0.294 6 |
| $\theta_{e,C}$               | 0.531 8 |
| $\theta_{g,d}$               | 1.283 4 |
| $\theta_{g,F}$               | 0.578 0 |
| $\theta_{h,g}$               | 0.498 1 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.756 5 |
| $\theta'_{e,C'}$             | 0.479 2 |
| $\theta'_{F',e}$             | 0.520 8 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.000 6 |
| $\Delta\theta_{C,A'}$ | 0.001 3  |
| $\Delta\theta_{g,d}$  | -0.004 2 |
| $\Delta\theta_{g,F}$  | -0.003 4 |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 350 |
| $\lambda_{70}$        | 400  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 390  | $\lambda_{0.05}$ | 349 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.55 | 2.68             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.08             |
| 360                    | 0.28             |
| 370                    | 0.52             |
| 380                    | 0.69             |
| 390                    | 0.80             |
| 400                    | 0.87             |
| 420                    | 0.936            |
| 440                    | 0.962            |
| 460                    | 0.976            |
| 480                    | 0.984            |
| 500                    | 0.990            |
| 550                    | 0.997            |
| 600                    | 0.998            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.997            |
| 1 800                  | 0.992            |
| 2 000                  | 0.977            |
| 2 200                  | 0.946            |
| 2 400                  | 0.82             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 646   |
| Annealing Point AP (°C)                                          | 678   |
| Transformation Temperature Tg (°C)                               | 692   |
| Yield Point At (°C)                                              | 735   |
| Softening Point SP (°C)                                          | 761   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 72    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 85    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.873 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 58                                             |
| -90 ~ -80                               | 59                                             |
| -80 ~ -70                               | 60                                             |
| -70 ~ -60                               | 62                                             |
| -60 ~ -50                               | 63                                             |
| -50 ~ -40                               | 64                                             |
| -40 ~ -30                               | 65                                             |
| -30 ~ -20                               | 67                                             |
| -20 ~ -10                               | 68                                             |
| -10 ~ 0                                 | 69                                             |
| 0 ~ 10                                  | 70                                             |
| 10 ~ 20                                 | 71                                             |
| 20 ~ 30                                 | 72                                             |
| 30 ~ 40                                 | 73                                             |
| 40 ~ 50                                 | 74                                             |
| 50 ~ 60                                 | 75                                             |
| 60 ~ 70                                 | 76                                             |
| 70 ~ 80                                 | 77                                             |
| 80 ~ 90                                 | 78                                             |
| 90 ~ 100                                | 78                                             |
| 100 ~ 110                               | 79                                             |
| 110 ~ 120                               | 80                                             |
| 120 ~ 130                               | 81                                             |
| 130 ~ 140                               | 82                                             |
| 140 ~ 150                               | 82                                             |
| 150 ~ 160                               | 83                                             |
| 160 ~ 170                               | 84                                             |
| 170 ~ 180                               | 84                                             |
| 180 ~ 190                               | 85                                             |
| 190 ~ 200                               | 85                                             |
| 200 ~ 210                               | 86                                             |
| 210 ~ 220                               | 86                                             |
| 220 ~ 230                               | 87                                             |
| 230 ~ 240                               | 87                                             |
| 240 ~ 250                               | 88                                             |
| 250 ~ 260                               | 88                                             |
| 260 ~ 270                               | 89                                             |
| 270 ~ 280                               | 89                                             |
| 280 ~ 290                               | 89                                             |
| 290 ~ 300                               | 90                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.12 |
| Specific Gravity $d$                                     | 4.87 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | 2.1                                                             | 2.3 | 2.9 | 3.2 | 3.2 | 3.6 | 3.9 | 4.6 | 4.8 | 5.7 | 6.8 | - |
| -60 ~ -40                                    | 2.0                                                             | 2.4 | 2.9 | 3.1 | 3.2 | 3.5 | 4.0 | 4.7 | 4.8 | 5.7 | 6.9 | - |
| -40 ~ -20                                    | 2.1                                                             | 2.4 | 3.0 | 3.2 | 3.4 | 3.7 | 4.1 | 4.8 | 4.9 | 5.9 | 7.1 | - |
| -20 ~ 0                                      | 2.2                                                             | 2.5 | 3.2 | 3.5 | 3.5 | 3.9 | 4.2 | 5.0 | 5.1 | 6.2 | 7.3 | - |
| 0 ~ 20                                       | 2.4                                                             | 2.7 | 3.4 | 3.6 | 3.7 | 4.0 | 4.4 | 5.2 | 5.3 | 6.4 | 7.6 | - |
| 20 ~ 40                                      | 2.6                                                             | 2.9 | 3.5 | 3.8 | 3.8 | 4.2 | 4.7 | 5.5 | 5.6 | 6.6 | 7.8 | - |
| 40 ~ 60                                      | 2.7                                                             | 3.0 | 3.7 | 3.9 | 4.1 | 4.5 | 4.8 | 5.7 | 5.8 | 6.8 | 8.0 | - |
| 60 ~ 80                                      | 2.8                                                             | 3.3 | 3.9 | 4.1 | 4.2 | 4.6 | 5.0 | 5.8 | 5.9 | 7.0 | 8.2 | - |
| 80 ~ 100                                     | 3.0                                                             | 3.3 | 4.0 | 4.2 | 4.4 | 4.8 | 5.2 | 6.0 | 6.1 | 7.2 | 8.4 | - |
| 100 ~ 120                                    | 3.1                                                             | 3.4 | 4.1 | 4.3 | 4.4 | 4.8 | 5.2 | 6.1 | 6.3 | 7.4 | 8.6 | - |
| 120 ~ 140                                    | 3.1                                                             | 3.4 | 4.1 | 4.4 | 4.5 | 4.9 | 5.3 | 6.2 | 6.3 | 7.5 | 8.8 | - |
| 140 ~ 160                                    | 3.1                                                             | 3.4 | 4.1 | 4.4 | 4.5 | 4.9 | 5.3 | 6.3 | 6.4 | 7.6 | 8.8 | - |
| 160 ~ 180                                    | 3.1                                                             | 3.5 | 4.2 | 4.4 | 4.5 | 4.9 | 5.3 | 6.3 | 6.4 | 7.6 | 8.8 | - |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.905 25<br>1.905 250 | Abbe Number $\nu_d$ | 35.04 | Dispersion $n_F - n_C$       | 0.025 838 |
| Refractive Index $n_e$ | 1.911 372             | Abbe Number $\nu_e$ | 34.79 | Dispersion $n_{F'} - n_{C'}$ | 0.026 200 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.854 01 |
| $n_{1970}$         | 1.970 09  | 1.860 68 |
| $n_{1530}$         | 1.529 58  | 1.868 34 |
| $n_{1129}$         | 1.128 64  | 1.876 30 |
| $n_t$              | 1.013 98  | 1.879 35 |
| $n_s$              | 0.852 11  | 1.885 17 |
| $n_{A'}$           | 0.768 19  | 1.889 44 |
| $n_F$              | 0.706 52  | 1.893 50 |
| $n_C$              | 0.656 27  | 1.897 68 |
| $n_{C'}$           | 0.643 85  | 1.898 86 |
| $n_{He-Ne}$        | 0.632 8   | 1.899 98 |
| $n_D$              | 0.589 29  | 1.905 02 |
| $n_d$              | 0.587 56  | 1.905 25 |
| $n_e$              | 0.546 07  | 1.911 37 |
| $n_F$              | 0.486 13  | 1.923 51 |
| $n_{F'}$           | 0.479 99  | 1.925 06 |
| $n_{He-Cd}$        | 0.441 57  | 1.936 58 |
| $n_g$              | 0.435 835 | 1.938 62 |
| $n_h$              | 0.404 656 | 1.951 76 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.178 843 78E+00 |
| $A_2$                           | 3.255 086 83E-01 |
| $A_3$                           | 1.706 086 46E+00 |
| $B_1$                           | 1.157 608 79E-02 |
| $B_2$                           | 4.959 825 03E-02 |
| $B_3$                           | 1.289 135 80E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 124.7 |
| Rigidity Modulus G (GPa) | 47.8  |
| Poisson's Ratio $\sigma$ | 0.304 |
| Knoop Hardness Hk[Class] | 690 7 |
| Abrasion Aa              | 60    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.018 330 |
| $n_C - n_{A'}$      | 0.008 240 |
| $n_d - n_C$         | 0.007 573 |
| $n_e - n_C$         | 0.013 695 |
| $n_g - n_d$         | 0.033 374 |
| $n_g - n_F$         | 0.015 109 |
| $n_h - n_g$         | 0.013 137 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.019 516 |
| $n_e - n_{C'}$      | 0.012 509 |
| $n_{F'} - n_e$      | 0.013 691 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.709 4 |
| $\theta_{C,A'}$              | 0.318 9 |
| $\theta_{d,C}$               | 0.293 1 |
| $\theta_{e,C}$               | 0.530 0 |
| $\theta_{g,d}$               | 1.291 7 |
| $\theta_{g,F}$               | 0.584 8 |
| $\theta_{h,g}$               | 0.508 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.744 9 |
| $\theta'_{e,C'}$             | 0.477 4 |
| $\theta'_{F',e}$             | 0.522 6 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.001 7 |
| $\Delta\theta_{C,A'}$ | 0.000 6  |
| $\Delta\theta_{g,d}$  | -0.000 2 |
| $\Delta\theta_{g,F}$  | 0.000 0  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 355 |
| $\lambda_{70}$        | 410  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 397  | $\lambda_{0.05}$ | 353 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 3.75 | 3.96             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.22             |
| 370                    | 0.48             |
| 380                    | 0.65             |
| 390                    | 0.75             |
| 400                    | 0.82             |
| 420                    | 0.901            |
| 440                    | 0.938            |
| 460                    | 0.959            |
| 480                    | 0.974            |
| 500                    | 0.984            |
| 550                    | 0.996            |
| 600                    | 0.998            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.998            |
| 1 800                  | 0.993            |
| 2 000                  | 0.979            |
| 2 200                  | 0.952            |
| 2 400                  | 0.84             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 645   |
| Annealing Point AP (°C)                                          | 672   |
| Transformation Temperature Tg (°C)                               | 688   |
| Yield Point At (°C)                                              | 733   |
| Softening Point SP (°C)                                          | 761   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 74    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 89    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.892 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 60                                             |
| -90 ~ -80                               | 61                                             |
| -80 ~ -70                               | 63                                             |
| -70 ~ -60                               | 64                                             |
| -60 ~ -50                               | 65                                             |
| -50 ~ -40                               | 66                                             |
| -40 ~ -30                               | 68                                             |
| -30 ~ -20                               | 69                                             |
| -20 ~ -10                               | 70                                             |
| -10 ~ 0                                 | 71                                             |
| 0 ~ 10                                  | 72                                             |
| 10 ~ 20                                 | 73                                             |
| 20 ~ 30                                 | 74                                             |
| 30 ~ 40                                 | 76                                             |
| 40 ~ 50                                 | 77                                             |
| 50 ~ 60                                 | 78                                             |
| 60 ~ 70                                 | 79                                             |
| 70 ~ 80                                 | 79                                             |
| 80 ~ 90                                 | 80                                             |
| 90 ~ 100                                | 81                                             |
| 100 ~ 110                               | 82                                             |
| 110 ~ 120                               | 83                                             |
| 120 ~ 130                               | 84                                             |
| 130 ~ 140                               | 85                                             |
| 140 ~ 150                               | 85                                             |
| 150 ~ 160                               | 86                                             |
| 160 ~ 170                               | 87                                             |
| 170 ~ 180                               | 88                                             |
| 180 ~ 190                               | 88                                             |
| 190 ~ 200                               | 89                                             |
| 200 ~ 210                               | 89                                             |
| 210 ~ 220                               | 90                                             |
| 220 ~ 230                               | 91                                             |
| 230 ~ 240                               | 91                                             |
| 240 ~ 250                               | 92                                             |
| 250 ~ 260                               | 92                                             |
| 260 ~ 270                               | 93                                             |
| 270 ~ 280                               | 93                                             |
| 280 ~ 290                               | 93                                             |
| 290 ~ 300                               | 94                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.10 |
| Specific Gravity $d$                                     | 4.83 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | 2.3                                                             | 2.5 | 3.2 | 3.4 | 3.5 | 3.8 | 4.1 | 5.0 | 5.1 | 6.1 | 7.4  | - |
| -60 ~ -40                                    | 2.3                                                             | 2.6 | 3.2 | 3.5 | 3.5 | 3.9 | 4.3 | 5.1 | 5.2 | 6.3 | 7.5  | - |
| -40 ~ -20                                    | 2.4                                                             | 2.7 | 3.4 | 3.6 | 3.7 | 4.0 | 4.4 | 5.3 | 5.4 | 6.6 | 7.8  | - |
| -20 ~ 0                                      | 2.5                                                             | 2.8 | 3.6 | 3.8 | 3.8 | 4.2 | 4.6 | 5.5 | 5.6 | 6.8 | 8.1  | - |
| 0 ~ 20                                       | 2.7                                                             | 3.1 | 3.8 | 4.0 | 4.1 | 4.5 | 4.9 | 5.8 | 5.9 | 7.2 | 8.5  | - |
| 20 ~ 40                                      | 2.9                                                             | 3.2 | 3.9 | 4.3 | 4.3 | 4.8 | 5.2 | 6.1 | 6.2 | 7.5 | 8.8  | - |
| 40 ~ 60                                      | 3.0                                                             | 3.4 | 4.1 | 4.5 | 4.6 | 5.0 | 5.4 | 6.4 | 6.5 | 7.8 | 9.2  | - |
| 60 ~ 80                                      | 3.2                                                             | 3.6 | 4.4 | 4.6 | 4.7 | 5.2 | 5.6 | 6.6 | 6.7 | 8.0 | 9.6  | - |
| 80 ~ 100                                     | 3.3                                                             | 3.7 | 4.5 | 4.7 | 4.9 | 5.4 | 5.8 | 6.9 | 7.0 | 8.4 | 9.9  | - |
| 100 ~ 120                                    | 3.4                                                             | 3.8 | 4.6 | 4.9 | 5.0 | 5.4 | 6.0 | 7.1 | 7.2 | 8.6 | 10.2 | - |
| 120 ~ 140                                    | 3.4                                                             | 3.9 | 4.7 | 5.0 | 5.1 | 5.5 | 6.0 | 7.2 | 7.4 | 8.8 | 10.4 | - |
| 140 ~ 160                                    | 3.5                                                             | 3.9 | 4.7 | 5.0 | 5.1 | 5.6 | 6.2 | 7.3 | 7.5 | 8.9 | 10.6 | - |
| 160 ~ 180                                    | 3.5                                                             | 3.9 | 4.8 | 5.1 | 5.2 | 5.7 | 6.2 | 7.4 | 7.5 | 9.0 | 10.7 | - |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.903 66<br>1.903 660 | Abbe Number $\nu_d$ | 31.34 | Dispersion $n_F - n_C$       | 0.028 832 |
| Refractive Index $n_e$ | 1.910 476             | Abbe Number $\nu_e$ | 31.10 | Dispersion $n_{F'} - n_{C'}$ | 0.029 272 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.848 25 |
| $n_{1970}$         | 1.970 09  | 1.855 30 |
| $n_{1530}$         | 1.529 58  | 1.863 42 |
| $n_{1129}$         | 1.128 64  | 1.871 94 |
| $n_t$              | 1.013 98  | 1.875 23 |
| $n_s$              | 0.852 11  | 1.881 55 |
| $n_{A'}$           | 0.768 19  | 1.886 22 |
| $n_F$              | 0.706 52  | 1.890 68 |
| $n_C$              | 0.656 27  | 1.895 28 |
| $n_{C'}$           | 0.643 85  | 1.896 59 |
| $n_{He-Ne}$        | 0.632 8   | 1.897 82 |
| $n_D$              | 0.589 29  | 1.903 41 |
| $n_d$              | 0.587 56  | 1.903 66 |
| $n_e$              | 0.546 07  | 1.910 48 |
| $n_F$              | 0.486 13  | 1.924 11 |
| $n_{F'}$           | 0.479 99  | 1.925 86 |
| $n_{He-Cd}$        | 0.441 57  | 1.938 96 |
| $n_g$              | 0.435 835 | 1.941 30 |
| $n_h$              | 0.404 656 | 1.956 48 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.156 366 17E+00 |
| $A_2$                           | 3.295 581 78E-01 |
| $A_3$                           | 1.721 789 35E+00 |
| $B_1$                           | 1.228 805 10E-02 |
| $B_2$                           | 5.555 078 35E-02 |
| $B_3$                           | 1.244 393 40E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 117.7 |
| Rigidity Modulus G (GPa) | 45.2  |
| Poisson's Ratio $\sigma$ | 0.302 |
| Knoop Hardness Hk[Class] | 660 7 |
| Abrasion Aa              | 85    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.020 047 |
| $n_C - n_{A'}$      | 0.009 057 |
| $n_d - n_C$         | 0.008 383 |
| $n_e - n_C$         | 0.015 199 |
| $n_g - n_d$         | 0.037 641 |
| $n_g - n_F$         | 0.017 192 |
| $n_h - n_g$         | 0.015 178 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.021 356 |
| $n_e - n_{C'}$      | 0.013 890 |
| $n_{F'} - n_e$      | 0.015 382 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.695 3 |
| $\theta_{C,A'}$              | 0.314 1 |
| $\theta_{d,C}$               | 0.290 8 |
| $\theta_{e,C}$               | 0.527 2 |
| $\theta_{g,d}$               | 1.305 5 |
| $\theta_{g,F}$               | 0.596 3 |
| $\theta_{h,g}$               | 0.526 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.729 6 |
| $\theta'_{e,C'}$             | 0.474 5 |
| $\theta'_{F,e}$              | 0.525 5 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.001 6 |
| $\Delta\theta_{C,A'}$ | 0.000 3 |
| $\Delta\theta_{g,d}$  | 0.005 9 |
| $\Delta\theta_{g,F}$  | 0.005 5 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 360 |
| $\lambda_{70}$        | 410  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 400  | $\lambda_{0.05}$ | 360 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 4.11 | 4.35             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.06             |
| 370                    | 0.31             |
| 380                    | 0.56             |
| 390                    | 0.71             |
| 400                    | 0.80             |
| 420                    | 0.89             |
| 440                    | 0.934            |
| 460                    | 0.956            |
| 480                    | 0.970            |
| 500                    | 0.980            |
| 550                    | 0.992            |
| 600                    | 0.995            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.995            |
| 1 800                  | 0.988            |
| 2 000                  | 0.972            |
| 2 200                  | 0.933            |
| 2 400                  | 0.81             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 615   |
| Annealing Point AP (°C)                                          | 638   |
| Transformation Temperature Tg (°C)                               | 650   |
| Yield Point At (°C)                                              | 686   |
| Softening Point SP (°C)                                          | 713   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 73    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 87    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.861 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 59                                             |
| -90 ~ -80                               | 60                                             |
| -80 ~ -70                               | 62                                             |
| -70 ~ -60                               | 63                                             |
| -60 ~ -50                               | 64                                             |
| -50 ~ -40                               | 65                                             |
| -40 ~ -30                               | 66                                             |
| -30 ~ -20                               | 68                                             |
| -20 ~ -10                               | 69                                             |
| -10 ~ 0                                 | 70                                             |
| 0 ~ 10                                  | 71                                             |
| 10 ~ 20                                 | 72                                             |
| 20 ~ 30                                 | 73                                             |
| 30 ~ 40                                 | 74                                             |
| 40 ~ 50                                 | 75                                             |
| 50 ~ 60                                 | 76                                             |
| 60 ~ 70                                 | 77                                             |
| 70 ~ 80                                 | 78                                             |
| 80 ~ 90                                 | 79                                             |
| 90 ~ 100                                | 80                                             |
| 100 ~ 110                               | 81                                             |
| 110 ~ 120                               | 81                                             |
| 120 ~ 130                               | 82                                             |
| 130 ~ 140                               | 83                                             |
| 140 ~ 150                               | 84                                             |
| 150 ~ 160                               | 85                                             |
| 160 ~ 170                               | 85                                             |
| 170 ~ 180                               | 86                                             |
| 180 ~ 190                               | 87                                             |
| 190 ~ 200                               | 87                                             |
| 200 ~ 210                               | 88                                             |
| 210 ~ 220                               | 89                                             |
| 220 ~ 230                               | 89                                             |
| 230 ~ 240                               | 90                                             |
| 240 ~ 250                               | 90                                             |
| 250 ~ 260                               | 91                                             |
| 260 ~ 270                               | 91                                             |
| 270 ~ 280                               | 92                                             |
| 280 ~ 290                               | 92                                             |
| 290 ~ 300                               | 93                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.43 |
| Specific Gravity $d$                                     | 4.64 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | 1.4                                                             | 1.6 | 2.4 | 2.6 | 2.6 | 3.0 | 3.4 | 4.3 | 4.5 | 5.6 | 7.1  | - |
| -60 ~ -40                                    | 1.4                                                             | 1.7 | 2.4 | 2.7 | 2.8 | 3.1 | 3.5 | 4.4 | 4.6 | 5.9 | 7.3  | - |
| -40 ~ -20                                    | 1.5                                                             | 1.9 | 2.6 | 2.8 | 2.9 | 3.3 | 3.7 | 4.7 | 4.8 | 6.2 | 7.7  | - |
| -20 ~ 0                                      | 1.7                                                             | 2.0 | 2.8 | 3.1 | 3.1 | 3.6 | 4.0 | 5.1 | 5.2 | 6.6 | 8.1  | - |
| 0 ~ 20                                       | 1.9                                                             | 2.3 | 3.1 | 3.3 | 3.4 | 3.8 | 4.3 | 5.3 | 5.5 | 7.0 | 8.6  | - |
| 20 ~ 40                                      | 2.1                                                             | 2.5 | 3.2 | 3.6 | 3.7 | 4.1 | 4.6 | 5.7 | 5.8 | 7.3 | 9.0  | - |
| 40 ~ 60                                      | 2.3                                                             | 2.7 | 3.5 | 3.7 | 3.9 | 4.4 | 4.9 | 6.0 | 6.1 | 7.6 | 9.4  | - |
| 60 ~ 80                                      | 2.4                                                             | 2.9 | 3.7 | 4.0 | 4.1 | 4.6 | 5.1 | 6.2 | 6.4 | 8.0 | 9.9  | - |
| 80 ~ 100                                     | 2.6                                                             | 3.0 | 3.8 | 4.1 | 4.3 | 4.8 | 5.4 | 6.5 | 6.7 | 8.3 | 10.2 | - |
| 100 ~ 120                                    | 2.7                                                             | 3.1 | 4.0 | 4.3 | 4.4 | 4.9 | 5.5 | 6.8 | 6.9 | 8.6 | 10.5 | - |
| 120 ~ 140                                    | 2.7                                                             | 3.2 | 4.1 | 4.4 | 4.5 | 5.0 | 5.6 | 6.9 | 7.1 | 8.8 | 10.8 | - |
| 140 ~ 160                                    | 2.7                                                             | 3.2 | 4.1 | 4.4 | 4.5 | 5.1 | 5.8 | 7.0 | 7.2 | 9.0 | 11.0 | - |
| 160 ~ 180                                    | 2.8                                                             | 3.2 | 4.2 | 4.5 | 4.6 | 5.2 | 5.8 | 7.1 | 7.3 | 9.1 | 11.1 | - |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.763 85<br>1.763 850 | Abbe Number $\nu_d$ | 48.49 | Dispersion $n_F - n_C$       | 0.015 753 |
| Refractive Index $n_e$ | 1.767 599             | Abbe Number $\nu_e$ | 48.21 | Dispersion $n_{F'} - n_{C'}$ | 0.015 923 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.725 43 |
| $n_{1970}$         | 1.970 09  | 1.731 68 |
| $n_{1530}$         | 1.529 58  | 1.738 48 |
| $n_{1129}$         | 1.128 64  | 1.744 81 |
| $n_t$              | 1.013 98  | 1.747 02 |
| $n_s$              | 0.852 11  | 1.751 03 |
| $n_{A'}$           | 0.768 19  | 1.753 85 |
| $n_F$              | 0.706 52  | 1.756 48 |
| $n_C$              | 0.656 27  | 1.759 13 |
| $n_{C'}$           | 0.643 85  | 1.759 88 |
| $n_{He-Ne}$        | 0.632 8   | 1.760 57 |
| $n_D$              | 0.589 29  | 1.763 71 |
| $n_d$              | 0.587 56  | 1.763 85 |
| $n_e$              | 0.546 07  | 1.767 60 |
| $n_F$              | 0.486 13  | 1.774 88 |
| $n_{F'}$           | 0.479 99  | 1.775 80 |
| $n_{He-Cd}$        | 0.441 57  | 1.782 51 |
| $n_g$              | 0.435 835 | 1.783 69 |
| $n_h$              | 0.404 656 | 1.791 12 |
| $n_i$              | 0.365 015 | 1.804 05 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.850 785 19E+00 |
| $A_2$                           | 1.892 048 54E-01 |
| $A_3$                           | 1.197 631 37E+00 |
| $B_1$                           | 9.406 575 41E-03 |
| $B_2$                           | 3.803 451 87E-02 |
| $B_3$                           | 1.014 268 35E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 5.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 118.7 |
| Rigidity Modulus G (GPa) | 45.8  |
| Poisson's Ratio $\sigma$ | 0.296 |
| Knoop Hardness Hk[Class] | 690 7 |
| Abrasion Aa              | 81    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.012 108 |
| $n_C - n_{A'}$      | 0.005 277 |
| $n_d - n_C$         | 0.004 721 |
| $n_e - n_C$         | 0.008 470 |
| $n_g - n_d$         | 0.019 837 |
| $n_g - n_F$         | 0.008 805 |
| $n_h - n_g$         | 0.007 429 |
| $n_i - n_g$         | 0.020 364 |
| $n_{C'} - n_t$      | 0.012 854 |
| $n_e - n_{C'}$      | 0.007 724 |
| $n_{F'} - n_e$      | 0.008 199 |
| $n_i - n_{F'}$      | 0.028 253 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.768 6 |
| $\theta_{C,A'}$              | 0.335 0 |
| $\theta_{d,C}$               | 0.299 7 |
| $\theta_{e,C}$               | 0.537 7 |
| $\theta_{g,d}$               | 1.259 3 |
| $\theta_{g,F}$               | 0.558 9 |
| $\theta_{h,g}$               | 0.471 6 |
| $\theta_{i,g}$               | 1.292 7 |
| $\theta'_{C,t}$              | 0.807 3 |
| $\theta'_{e,C'}$             | 0.485 1 |
| $\theta'_{F',e}$             | 0.514 9 |
| $\theta'_{i,F'}$             | 1.774 4 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.005 6 |
| $\Delta\theta_{C,A'}$ | 0.000 4  |
| $\Delta\theta_{g,d}$  | -0.004 7 |
| $\Delta\theta_{g,F}$  | -0.004 1 |
| $\Delta\theta_{i,g}$  | -0.026 3 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 400  | $\lambda_5$      | 345 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 378  | $\lambda_{0.05}$ | 342 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.09 | 1.11             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.02             |
| 350                    | 0.19             |
| 360                    | 0.48             |
| 370                    | 0.71             |
| 380                    | 0.83             |
| 390                    | 0.905            |
| 400                    | 0.941            |
| 420                    | 0.972            |
| 440                    | 0.982            |
| 460                    | 0.988            |
| 480                    | 0.992            |
| 500                    | 0.994            |
| 550                    | 0.996            |
| 600                    | 0.996            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.997            |
| 900                    | 0.996            |
| 1 000                  | 0.996            |
| 1 200                  | 0.997            |
| 1 400                  | 0.995            |
| 1 600                  | 0.995            |
| 1 800                  | 0.989            |
| 2 000                  | 0.972            |
| 2 200                  | 0.930            |
| 2 400                  | 0.76             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 632   |
| Yield Point At (°C)                                              | 660   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 71    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 85    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.890 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 57                                             |
| -90 ~ -80                               | 58                                             |
| -80 ~ -70                               | 59                                             |
| -70 ~ -60                               | 61                                             |
| -60 ~ -50                               | 62                                             |
| -50 ~ -40                               | 63                                             |
| -40 ~ -30                               | 64                                             |
| -30 ~ -20                               | 65                                             |
| -20 ~ -10                               | 67                                             |
| -10 ~ 0                                 | 68                                             |
| 0 ~ 10                                  | 69                                             |
| 10 ~ 20                                 | 70                                             |
| 20 ~ 30                                 | 71                                             |
| 30 ~ 40                                 | 72                                             |
| 40 ~ 50                                 | 73                                             |
| 50 ~ 60                                 | 74                                             |
| 60 ~ 70                                 | 75                                             |
| 70 ~ 80                                 | 76                                             |
| 80 ~ 90                                 | 77                                             |
| 90 ~ 100                                | 78                                             |
| 100 ~ 110                               | 79                                             |
| 110 ~ 120                               | 80                                             |
| 120 ~ 130                               | 80                                             |
| 130 ~ 140                               | 81                                             |
| 140 ~ 150                               | 82                                             |
| 150 ~ 160                               | 83                                             |
| 160 ~ 170                               | 84                                             |
| 170 ~ 180                               | 84                                             |
| 180 ~ 190                               | 85                                             |
| 190 ~ 200                               | 86                                             |
| 200 ~ 210                               | 86                                             |
| 210 ~ 220                               | 87                                             |
| 220 ~ 230                               | 87                                             |
| 230 ~ 240                               | 88                                             |
| 240 ~ 250                               | 89                                             |
| 250 ~ 260                               | 89                                             |
| 260 ~ 270                               | 90                                             |
| 270 ~ 280                               | 90                                             |
| 280 ~ 290                               | 90                                             |
| 290 ~ 300                               | 91                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.12 |
| Specific Gravity $d$                                     | 4.54 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.5                                                             | 1.8 | 2.1 | 2.2 | 2.3 | 2.4 | 2.6 | 3.1 | 3.2 | 3.6 | 4.2 | 5.1 |
| -60 ~ -40                                    | 1.5                                                             | 1.6 | 2.0 | 2.1 | 2.2 | 2.3 | 2.6 | 3.0 | 3.1 | 3.6 | 4.1 | 5.1 |
| -40 ~ -20                                    | 1.4                                                             | 1.7 | 2.0 | 2.2 | 2.2 | 2.4 | 2.6 | 3.0 | 3.1 | 3.7 | 4.2 | 5.2 |
| -20 ~ 0                                      | 1.5                                                             | 1.7 | 2.1 | 2.2 | 2.2 | 2.4 | 2.8 | 3.2 | 3.2 | 3.8 | 4.3 | 5.3 |
| 0 ~ 20                                       | 1.5                                                             | 1.7 | 2.1 | 2.4 | 2.4 | 2.6 | 2.8 | 3.3 | 3.4 | 3.9 | 4.5 | 5.6 |
| 20 ~ 40                                      | 1.6                                                             | 1.8 | 2.3 | 2.4 | 2.5 | 2.7 | 2.9 | 3.5 | 3.5 | 4.1 | 4.7 | 5.8 |
| 40 ~ 60                                      | 1.7                                                             | 1.9 | 2.4 | 2.5 | 2.7 | 2.9 | 3.1 | 3.6 | 3.7 | 4.3 | 4.9 | 6.0 |
| 60 ~ 80                                      | 1.8                                                             | 2.1 | 2.5 | 2.7 | 2.7 | 3.0 | 3.2 | 3.7 | 3.8 | 4.4 | 5.0 | 6.3 |
| 80 ~ 100                                     | 1.9                                                             | 2.1 | 2.7 | 2.8 | 2.9 | 3.1 | 3.4 | 3.9 | 3.9 | 4.6 | 5.2 | 6.4 |
| 100 ~ 120                                    | 1.9                                                             | 2.2 | 2.7 | 2.8 | 3.0 | 3.2 | 3.5 | 4.0 | 4.1 | 4.7 | 5.4 | 6.6 |
| 120 ~ 140                                    | 1.9                                                             | 2.3 | 2.8 | 3.0 | 3.0 | 3.3 | 3.5 | 4.1 | 4.2 | 4.8 | 5.5 | 6.8 |
| 140 ~ 160                                    | 2.0                                                             | 2.3 | 2.8 | 3.0 | 3.0 | 3.3 | 3.6 | 4.2 | 4.2 | 4.9 | 5.6 | 6.9 |
| 160 ~ 180                                    | 2.0                                                             | 2.3 | 2.8 | 3.0 | 3.0 | 3.3 | 3.6 | 4.2 | 4.2 | 4.9 | 5.6 | 7.0 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.755 00<br>1.755 000 | Abbe Number $\nu_d$ | 52.32 | Dispersion $n_F - n_C$       | 0.014 431 |
| Refractive Index $n_e$ | 1.758 440             | Abbe Number $\nu_e$ | 52.08 | Dispersion $n_{F'} - n_{C'}$ | 0.014 562 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.714 14 |
| $n_{1970}$         | 1.970 09  | 1.721 71 |
| $n_{1530}$         | 1.529 58  | 1.729 70 |
| $n_{1129}$         | 1.128 64  | 1.736 66 |
| $n_t$              | 1.013 98  | 1.738 95 |
| $n_s$              | 0.852 11  | 1.742 93 |
| $n_{A'}$           | 0.768 19  | 1.745 65 |
| $n_F$              | 0.706 52  | 1.748 14 |
| $n_C$              | 0.656 27  | 1.750 63 |
| $n_{C'}$           | 0.643 85  | 1.751 32 |
| $n_{He-Ne}$        | 0.632 8   | 1.751 97 |
| $n_D$              | 0.589 29  | 1.754 87 |
| $n_d$              | 0.587 56  | 1.755 00 |
| $n_e$              | 0.546 07  | 1.758 44 |
| $n_F$              | 0.486 13  | 1.765 06 |
| $n_{F'}$           | 0.479 99  | 1.765 88 |
| $n_{He-Cd}$        | 0.441 57  | 1.771 91 |
| $n_g$              | 0.435 835 | 1.772 96 |
| $n_h$              | 0.404 656 | 1.779 54 |
| $n_i$              | 0.365 015 | 1.790 82 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.027 301 80E+00 |
| $A_2$                           | 9.892 935 64E-01 |
| $A_3$                           | 1.257 810 57E+00 |
| $B_1$                           | 1.834 061 29E-02 |
| $B_2$                           | 3.712 641 95E-03 |
| $B_3$                           | 8.785 105 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 120.9 |
| Rigidity Modulus G (GPa) | 46.7  |
| Poisson's Ratio $\sigma$ | 0.295 |
| Knoop Hardness Hk[Class] | 730 7 |
| Abrasion Aa              | 62    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 678 |
| $n_C - n_{A'}$      | 0.004 974 |
| $n_d - n_C$         | 0.004 373 |
| $n_e - n_C$         | 0.007 813 |
| $n_g - n_d$         | 0.017 958 |
| $n_g - n_F$         | 0.007 900 |
| $n_h - n_g$         | 0.006 585 |
| $n_i - n_g$         | 0.017 860 |
| $n_{C'} - n_t$      | 0.012 373 |
| $n_e - n_{C'}$      | 0.007 118 |
| $n_{F'} - n_e$      | 0.007 444 |
| $n_i - n_{F'}$      | 0.024 934 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.809 2 |
| $\theta_{C,A'}$              | 0.344 7 |
| $\theta_{d,C}$               | 0.303 0 |
| $\theta_{e,C}$               | 0.541 4 |
| $\theta_{g,d}$               | 1.244 4 |
| $\theta_{g,F}$               | 0.547 4 |
| $\theta_{h,g}$               | 0.456 3 |
| $\theta_{i,g}$               | 1.237 6 |
| $\theta'_{C,t}$              | 0.849 7 |
| $\theta'_{e,C'}$             | 0.488 8 |
| $\theta'_{F,e}$              | 0.511 2 |
| $\theta'_{i,F'}$             | 1.712 3 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.017 0  |
| $\Delta\theta_{C,A'}$ | 0.005 4  |
| $\Delta\theta_{g,d}$  | -0.011 7 |
| $\Delta\theta_{g,F}$  | -0.009 4 |
| $\Delta\theta_{i,g}$  | -0.049 3 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 355  | $\lambda_5$      |     |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 328  | $\lambda_{0.05}$ | 272 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.21 | 0.21             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.28             |
| 290                    | 0.43             |
| 300                    | 0.55             |
| 310                    | 0.65             |
| 320                    | 0.74             |
| 330                    | 0.82             |
| 340                    | 0.88             |
| 350                    | 0.923            |
| 360                    | 0.951            |
| 370                    | 0.969            |
| 380                    | 0.980            |
| 390                    | 0.986            |
| 400                    | 0.990            |
| 420                    | 0.993            |
| 440                    | 0.995            |
| 460                    | 0.997            |
| 480                    | 0.998            |
| 500                    | 0.999            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.995            |
| 1 600                  | 0.994            |
| 1 800                  | 0.984            |
| 2 000                  | 0.956            |
| 2 200                  | 0.87             |
| 2 400                  | 0.61             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 644   |
| Annealing Point AP (°C)                                          | 670   |
| Transformation Temperature Tg (°C)                               | 690   |
| Yield Point At (°C)                                              | 710   |
| Softening Point SP (°C)                                          | 721   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 60    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 74    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.863 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 47                                             |
| -90 ~ -80                               | 48                                             |
| -80 ~ -70                               | 50                                             |
| -70 ~ -60                               | 51                                             |
| -60 ~ -50                               | 52                                             |
| -50 ~ -40                               | 53                                             |
| -40 ~ -30                               | 54                                             |
| -30 ~ -20                               | 55                                             |
| -20 ~ -10                               | 56                                             |
| -10 ~ 0                                 | 57                                             |
| 0 ~ 10                                  | 58                                             |
| 10 ~ 20                                 | 59                                             |
| 20 ~ 30                                 | 60                                             |
| 30 ~ 40                                 | 61                                             |
| 40 ~ 50                                 | 62                                             |
| 50 ~ 60                                 | 63                                             |
| 60 ~ 70                                 | 64                                             |
| 70 ~ 80                                 | 65                                             |
| 80 ~ 90                                 | 66                                             |
| 90 ~ 100                                | 67                                             |
| 100 ~ 110                               | 68                                             |
| 110 ~ 120                               | 68                                             |
| 120 ~ 130                               | 69                                             |
| 130 ~ 140                               | 70                                             |
| 140 ~ 150                               | 71                                             |
| 150 ~ 160                               | 71                                             |
| 160 ~ 170                               | 72                                             |
| 170 ~ 180                               | 73                                             |
| 180 ~ 190                               | 73                                             |
| 190 ~ 200                               | 74                                             |
| 200 ~ 210                               | 75                                             |
| 210 ~ 220                               | 75                                             |
| 220 ~ 230                               | 76                                             |
| 230 ~ 240                               | 76                                             |
| 240 ~ 250                               | 77                                             |
| 250 ~ 260                               | 77                                             |
| 260 ~ 270                               | 78                                             |
| 270 ~ 280                               | 78                                             |
| 280 ~ 290                               | 79                                             |
| 290 ~ 300                               | 79                                             |

| Other Properties                                        |      |
|---------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>105</sup> Pa) | 1.39 |
| Specific Gravity $d$                                    | 4.17 |
| Remarks                                                 |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.4                                                             | 2.7 | 2.9 | 3.0 | 3.0 | 3.2 | 3.3 | 3.7 | 3.7 | 4.1 | 4.4 | 5.1 |
| -60 ~ -40                                    | 2.2                                                             | 2.5 | 2.8 | 2.9 | 2.9 | 3.0 | 3.2 | 3.6 | 3.6 | 4.0 | 4.3 | 5.1 |
| -40 ~ -20                                    | 2.2                                                             | 2.4 | 2.8 | 2.9 | 2.9 | 3.1 | 3.2 | 3.5 | 3.6 | 3.9 | 4.4 | 5.1 |
| -20 ~ 0                                      | 2.3                                                             | 2.5 | 2.8 | 2.9 | 2.9 | 3.1 | 3.2 | 3.7 | 3.7 | 4.1 | 4.5 | 5.2 |
| 0 ~ 20                                       | 2.4                                                             | 2.5 | 2.9 | 3.1 | 3.0 | 3.3 | 3.4 | 3.8 | 3.8 | 4.2 | 4.6 | 5.3 |
| 20 ~ 40                                      | 2.5                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.3 | 3.5 | 3.9 | 4.0 | 4.4 | 4.8 | 5.6 |
| 40 ~ 60                                      | 2.6                                                             | 2.8 | 3.1 | 3.2 | 3.3 | 3.5 | 3.7 | 4.1 | 4.1 | 4.6 | 5.0 | 5.8 |
| 60 ~ 80                                      | 2.7                                                             | 2.9 | 3.3 | 3.4 | 3.5 | 3.6 | 3.8 | 4.2 | 4.3 | 4.7 | 5.1 | 6.1 |
| 80 ~ 100                                     | 2.8                                                             | 3.0 | 3.5 | 3.6 | 3.6 | 3.8 | 4.0 | 4.4 | 4.5 | 4.9 | 5.4 | 6.2 |
| 100 ~ 120                                    | 2.9                                                             | 3.1 | 3.5 | 3.7 | 3.8 | 4.0 | 4.2 | 4.6 | 4.6 | 5.1 | 5.6 | 6.4 |
| 120 ~ 140                                    | 3.0                                                             | 3.3 | 3.7 | 3.9 | 3.9 | 4.1 | 4.3 | 4.7 | 4.8 | 5.3 | 5.8 | 6.6 |
| 140 ~ 160                                    | 3.2                                                             | 3.4 | 3.8 | 4.0 | 4.0 | 4.2 | 4.4 | 4.8 | 4.9 | 5.4 | 5.9 | 6.8 |
| 160 ~ 180                                    | 3.2                                                             | 3.4 | 3.9 | 4.0 | 4.1 | 4.3 | 4.5 | 4.9 | 5.0 | 5.5 | 6.0 | 7.0 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.953 75<br>1.953 750 | Abbe Number $\nu_d$ | 32.32 | Dispersion $n_F - n_C$       | 0.029 506 |
| Refractive Index $n_e$ | 1.960 733             | Abbe Number $\nu_e$ | 32.09 | Dispersion $n_{F'} - n_{C'}$ | 0.029 940 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.897 37 |
| $n_{1970}$         | 1.970 09  | 1.904 36 |
| $n_{1530}$         | 1.529 58  | 1.912 50 |
| $n_{1129}$         | 1.128 64  | 1.921 15 |
| $n_t$              | 1.013 98  | 1.924 52 |
| $n_s$              | 0.852 11  | 1.931 02 |
| $n_{A'}$           | 0.768 19  | 1.935 82 |
| $n_F$              | 0.706 52  | 1.940 42 |
| $n_C$              | 0.656 27  | 1.945 14 |
| $n_{C'}$           | 0.643 85  | 1.946 49 |
| $n_{He-Ne}$        | 0.632 8   | 1.947 75 |
| $n_D$              | 0.589 29  | 1.953 49 |
| $n_d$              | 0.587 56  | 1.953 75 |
| $n_e$              | 0.546 07  | 1.960 73 |
| $n_F$              | 0.486 13  | 1.974 65 |
| $n_{F'}$           | 0.479 99  | 1.976 43 |
| $n_{He-Cd}$        | 0.441 57  | 1.989 70 |
| $n_g$              | 0.435 835 | 1.992 07 |
| $n_h$              | 0.404 656 | 2.007 32 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.285 106 29E+00 |
| $A_2$                           | 3.855 322 64E-01 |
| $A_3$                           | 2.065 511 20E+00 |
| $B_1$                           | 1.221 789 62E-02 |
| $B_2$                           | 5.147 523 42E-02 |
| $B_3$                           | 1.459 208 70E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 3.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 129.3 |
| Rigidity Modulus G (GPa) | 49.5  |
| Poisson's Ratio $\sigma$ | 0.306 |
| Knoop Hardness Hk[Class] | 730 7 |
| Abrasion Aa              | 55    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.020 620 |
| $n_C - n_{A'}$      | 0.009 319 |
| $n_d - n_C$         | 0.008 609 |
| $n_e - n_C$         | 0.015 592 |
| $n_g - n_d$         | 0.038 320 |
| $n_g - n_F$         | 0.017 423 |
| $n_h - n_g$         | 0.015 249 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.021 965 |
| $n_e - n_{C'}$      | 0.014 247 |
| $n_{F'} - n_e$      | 0.015 693 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.698 8 |
| $\theta_{C,A'}$              | 0.315 8 |
| $\theta_{d,C}$               | 0.291 8 |
| $\theta_{e,C}$               | 0.528 4 |
| $\theta_{g,d}$               | 1.298 7 |
| $\theta_{g,F}$               | 0.590 5 |
| $\theta_{h,g}$               | 0.516 8 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.733 6 |
| $\theta'_{e,C'}$             | 0.475 9 |
| $\theta'_{F',e}$             | 0.524 1 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.000 5 |
| $\Delta\theta_{C,A'}$ | 0.000 8 |
| $\Delta\theta_{g,d}$  | 0.001 1 |
| $\Delta\theta_{g,F}$  | 0.001 3 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 355 |
| $\lambda_{70}$        | 405  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 390  | $\lambda_{0.05}$ | 352 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.90 | 3.06             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.02             |
| 360                    | 0.18             |
| 370                    | 0.47             |
| 380                    | 0.68             |
| 390                    | 0.80             |
| 400                    | 0.86             |
| 420                    | 0.927            |
| 440                    | 0.953            |
| 460                    | 0.967            |
| 480                    | 0.978            |
| 500                    | 0.986            |
| 550                    | 0.996            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.998            |
| 1 800                  | 0.993            |
| 2 000                  | 0.979            |
| 2 200                  | 0.952            |
| 2 400                  | 0.84             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 680   |
| Annealing Point AP (°C)                                          | 716   |
| Transformation Temperature Tg (°C)                               | 724   |
| Yield Point At (°C)                                              | 757   |
| Softening Point SP (°C)                                          | 791   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 74    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 88    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.924 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 60                                             |
| -90 ~ -80                               | 61                                             |
| -80 ~ -70                               | 63                                             |
| -70 ~ -60                               | 64                                             |
| -60 ~ -50                               | 65                                             |
| -50 ~ -40                               | 66                                             |
| -40 ~ -30                               | 68                                             |
| -30 ~ -20                               | 69                                             |
| -20 ~ -10                               | 70                                             |
| -10 ~ 0                                 | 71                                             |
| 0 ~ 10                                  | 72                                             |
| 10 ~ 20                                 | 74                                             |
| 20 ~ 30                                 | 75                                             |
| 30 ~ 40                                 | 76                                             |
| 40 ~ 50                                 | 77                                             |
| 50 ~ 60                                 | 78                                             |
| 60 ~ 70                                 | 79                                             |
| 70 ~ 80                                 | 80                                             |
| 80 ~ 90                                 | 80                                             |
| 90 ~ 100                                | 81                                             |
| 100 ~ 110                               | 82                                             |
| 110 ~ 120                               | 83                                             |
| 120 ~ 130                               | 84                                             |
| 130 ~ 140                               | 85                                             |
| 140 ~ 150                               | 85                                             |
| 150 ~ 160                               | 86                                             |
| 160 ~ 170                               | 87                                             |
| 170 ~ 180                               | 87                                             |
| 180 ~ 190                               | 88                                             |
| 190 ~ 200                               | 89                                             |
| 200 ~ 210                               | 89                                             |
| 210 ~ 220                               | 90                                             |
| 220 ~ 230                               | 90                                             |
| 230 ~ 240                               | 91                                             |
| 240 ~ 250                               | 91                                             |
| 250 ~ 260                               | 92                                             |
| 260 ~ 270                               | 92                                             |
| 270 ~ 280                               | 92                                             |
| 280 ~ 290                               | 93                                             |
| 290 ~ 300                               | 93                                             |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 0.86 |
| Specific Gravity $d$                        | 4.94 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | 1.1                                                             | 1.4 | 2.1 | 2.3 | 2.3 | 2.7 | 3.0 | 4.0 | 4.1 | 5.2 | 6.7  | - |
| -60 ~ -40                                    | 1.0                                                             | 1.4 | 2.0 | 2.2 | 2.3 | 2.7 | 3.1 | 4.0 | 4.1 | 5.3 | 6.8  | - |
| -40 ~ -20                                    | 1.2                                                             | 1.5 | 2.1 | 2.3 | 2.4 | 2.8 | 3.3 | 4.2 | 4.3 | 5.6 | 7.2  | - |
| -20 ~ 0                                      | 1.3                                                             | 1.6 | 2.2 | 2.5 | 2.5 | 3.1 | 3.5 | 4.4 | 4.6 | 5.9 | 7.5  | - |
| 0 ~ 20                                       | 1.4                                                             | 1.7 | 2.4 | 2.7 | 2.8 | 3.3 | 3.7 | 4.7 | 4.9 | 6.2 | 7.8  | - |
| 20 ~ 40                                      | 1.5                                                             | 1.9 | 2.7 | 2.9 | 3.0 | 3.5 | 3.9 | 5.0 | 5.1 | 6.6 | 8.3  | - |
| 40 ~ 60                                      | 1.8                                                             | 2.1 | 2.9 | 3.2 | 3.2 | 3.7 | 4.2 | 5.3 | 5.4 | 7.0 | 8.7  | - |
| 60 ~ 80                                      | 1.9                                                             | 2.2 | 3.0 | 3.3 | 3.4 | 3.9 | 4.4 | 5.6 | 5.8 | 7.3 | 9.1  | - |
| 80 ~ 100                                     | 1.9                                                             | 2.4 | 3.3 | 3.5 | 3.6 | 4.1 | 4.6 | 5.8 | 6.0 | 7.6 | 9.4  | - |
| 100 ~ 120                                    | 2.0                                                             | 2.4 | 3.3 | 3.7 | 3.8 | 4.3 | 4.9 | 6.1 | 6.2 | 7.9 | 9.8  | - |
| 120 ~ 140                                    | 2.1                                                             | 2.5 | 3.5 | 3.8 | 3.9 | 4.4 | 5.0 | 6.2 | 6.4 | 8.1 | 10.1 | - |
| 140 ~ 160                                    | 2.1                                                             | 2.6 | 3.6 | 3.9 | 4.0 | 4.5 | 5.1 | 6.4 | 6.6 | 8.3 | 10.4 | - |
| 160 ~ 180                                    | 2.2                                                             | 2.6 | 3.6 | 3.9 | 4.0 | 4.6 | 5.2 | 6.5 | 6.7 | 8.5 | 10.6 | - |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 2.001 00<br>2.001 000 | Abbe Number $\nu_d$ | 29.14 | Dispersion $n_F - n_C$       | 0.034 352 |
| Refractive Index $n_e$ | 2.009 118             | Abbe Number $\nu_e$ | 28.92 | Dispersion $n_{F'} - n_{C'}$ | 0.034 895 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.938 63 |
| $n_{1970}$         | 1.970 09  | 1.945 85 |
| $n_{1530}$         | 1.529 58  | 1.954 40 |
| $n_{1129}$         | 1.128 64  | 1.963 80 |
| $n_t$              | 1.013 98  | 1.967 56 |
| $n_s$              | 0.852 11  | 1.974 88 |
| $n_{A'}$           | 0.768 19  | 1.980 35 |
| $n_F$              | 0.706 52  | 1.985 61 |
| $n_C$              | 0.656 27  | 1.991 05 |
| $n_{C'}$           | 0.643 85  | 1.992 60 |
| $n_{He-Ne}$        | 0.632 8   | 1.994 06 |
| $n_D$              | 0.589 29  | 2.000 70 |
| $n_d$              | 0.587 56  | 2.001 00 |
| $n_e$              | 0.546 07  | 2.009 12 |
| $n_F$              | 0.486 13  | 2.025 40 |
| $n_{F'}$           | 0.479 99  | 2.027 49 |
| $n_{He-Cd}$        | 0.441 57  | 2.043 19 |
| $n_g$              | 0.435 835 | 2.046 00 |
| $n_h$              | 0.404 656 | 2.064 24 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.391 406 62E+00 |
| $A_2$                           | 4.392 192 28E-01 |
| $A_3$                           | 2.383 584 67E+00 |
| $B_1$                           | 1.314 675 00E-02 |
| $B_2$                           | 5.532 260 42E-02 |
| $B_3$                           | 1.612 599 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 2.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 131.3 |
| Rigidity Modulus G (GPa) | 50.2  |
| Poisson's Ratio $\sigma$ | 0.307 |
| Knoop Hardness Hk[Class] | 720 7 |
| Abrasion Aa              | 55    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.023 490 |
| $n_C - n_{A'}$      | 0.010 695 |
| $n_d - n_C$         | 0.009 952 |
| $n_e - n_C$         | 0.018 070 |
| $n_g - n_d$         | 0.045 001 |
| $n_g - n_F$         | 0.020 601 |
| $n_h - n_g$         | 0.018 235 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.025 041 |
| $n_e - n_{C'}$      | 0.016 519 |
| $n_{F'} - n_e$      | 0.018 376 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.683 8 |
| $\theta_{C,A'}$              | 0.311 3 |
| $\theta_{d,C}$               | 0.289 7 |
| $\theta_{e,C}$               | 0.526 0 |
| $\theta_{g,d}$               | 1.310 0 |
| $\theta_{g,F}$               | 0.599 7 |
| $\theta_{h,g}$               | 0.530 8 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.717 6 |
| $\theta'_{e,C'}$             | 0.473 4 |
| $\theta'_{F,e}$              | 0.526 6 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.000 4 |
| $\Delta\theta_{C,A'}$ | 0.000 1 |
| $\Delta\theta_{g,d}$  | 0.005 8 |
| $\Delta\theta_{g,F}$  | 0.005 4 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 360 |
| $\lambda_{70}$        | 425  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 407  | $\lambda_{0.05}$ | 360 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 5.00 | 5.23             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.05             |
| 370                    | 0.25             |
| 380                    | 0.49             |
| 390                    | 0.66             |
| 400                    | 0.76             |
| 420                    | 0.87             |
| 440                    | 0.924            |
| 460                    | 0.951            |
| 480                    | 0.968            |
| 500                    | 0.980            |
| 550                    | 0.995            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.998            |
| 1 800                  | 0.995            |
| 2 000                  | 0.983            |
| 2 200                  | 0.964            |
| 2 400                  | 0.88             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 682   |
| Annealing Point AP (°C)                                          | 718   |
| Transformation Temperature Tg (°C)                               | 727   |
| Yield Point At (°C)                                              | 763   |
| Softening Point SP (°C)                                          | 792   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 76    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 90    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.944 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 62                                             |
| -90 ~ -80                               | 64                                             |
| -80 ~ -70                               | 65                                             |
| -70 ~ -60                               | 66                                             |
| -60 ~ -50                               | 67                                             |
| -50 ~ -40                               | 68                                             |
| -40 ~ -30                               | 70                                             |
| -30 ~ -20                               | 71                                             |
| -20 ~ -10                               | 72                                             |
| -10 ~ 0                                 | 73                                             |
| 0 ~ 10                                  | 74                                             |
| 10 ~ 20                                 | 75                                             |
| 20 ~ 30                                 | 76                                             |
| 30 ~ 40                                 | 77                                             |
| 40 ~ 50                                 | 78                                             |
| 50 ~ 60                                 | 79                                             |
| 60 ~ 70                                 | 80                                             |
| 70 ~ 80                                 | 81                                             |
| 80 ~ 90                                 | 82                                             |
| 90 ~ 100                                | 83                                             |
| 100 ~ 110                               | 84                                             |
| 110 ~ 120                               | 84                                             |
| 120 ~ 130                               | 85                                             |
| 130 ~ 140                               | 86                                             |
| 140 ~ 150                               | 87                                             |
| 150 ~ 160                               | 87                                             |
| 160 ~ 170                               | 88                                             |
| 170 ~ 180                               | 89                                             |
| 180 ~ 190                               | 89                                             |
| 190 ~ 200                               | 90                                             |
| 200 ~ 210                               | 91                                             |
| 210 ~ 220                               | 91                                             |
| 220 ~ 230                               | 92                                             |
| 230 ~ 240                               | 92                                             |
| 240 ~ 250                               | 93                                             |
| 250 ~ 260                               | 93                                             |
| 260 ~ 270                               | 94                                             |
| 270 ~ 280                               | 94                                             |
| 280 ~ 290                               | 94                                             |
| 290 ~ 300                               | 95                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 0.76 |
| Specific Gravity $d$                                      | 5.02 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | 0.7                                                             | 1.0 | 1.7 | 2.0 | 2.1 | 2.5 | 2.9 | 4.0 | 4.2 | 5.5 | 7.2  | - |
| -60 ~ -40                                    | 0.6                                                             | 0.9 | 1.7 | 2.0 | 2.0 | 2.5 | 2.9 | 4.1 | 4.2 | 5.7 | 7.5  | - |
| -40 ~ -20                                    | 0.6                                                             | 1.0 | 1.8 | 2.1 | 2.2 | 2.6 | 3.1 | 4.3 | 4.5 | 6.0 | 7.8  | - |
| -20 ~ 0                                      | 0.7                                                             | 1.2 | 2.0 | 2.3 | 2.4 | 2.8 | 3.3 | 4.6 | 4.8 | 6.3 | 8.2  | - |
| 0 ~ 20                                       | 0.9                                                             | 1.3 | 2.2 | 2.5 | 2.6 | 3.1 | 3.6 | 4.8 | 5.0 | 6.7 | 8.7  | - |
| 20 ~ 40                                      | 1.1                                                             | 1.5 | 2.4 | 2.7 | 2.8 | 3.3 | 4.0 | 5.2 | 5.4 | 7.1 | 9.1  | - |
| 40 ~ 60                                      | 1.3                                                             | 1.7 | 2.6 | 2.9 | 3.0 | 3.6 | 4.2 | 5.6 | 5.8 | 7.5 | 9.6  | - |
| 60 ~ 80                                      | 1.4                                                             | 1.8 | 2.8 | 3.2 | 3.2 | 3.9 | 4.5 | 5.9 | 6.1 | 7.9 | 10.1 | - |
| 80 ~ 100                                     | 1.6                                                             | 2.1 | 3.1 | 3.4 | 3.5 | 4.1 | 4.7 | 6.1 | 6.3 | 8.4 | 10.6 | - |
| 100 ~ 120                                    | 1.7                                                             | 2.2 | 3.3 | 3.6 | 3.7 | 4.4 | 5.0 | 6.4 | 6.7 | 8.6 | 11.0 | - |
| 120 ~ 140                                    | 1.8                                                             | 2.4 | 3.4 | 3.8 | 3.9 | 4.6 | 5.2 | 6.7 | 6.9 | 9.0 | 11.4 | - |
| 140 ~ 160                                    | 1.9                                                             | 2.4 | 3.5 | 3.9 | 4.1 | 4.7 | 5.4 | 7.0 | 7.2 | 9.3 | 11.8 | - |
| 160 ~ 180                                    | 2.0                                                             | 2.5 | 3.6 | 4.0 | 4.1 | 4.8 | 5.5 | 7.1 | 7.4 | 9.6 | 12.2 | - |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 2.001 00<br>2.001 000 | Abbe Number $\nu_d$ | 29.14 | Dispersion $n_F - n_C$       | 0.034 352 |
| Refractive Index $n_e$ | 2.009 118             | Abbe Number $\nu_e$ | 28.92 | Dispersion $n_{F'} - n_{C'}$ | 0.034 895 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.938 63 |
| $n_{1970}$         | 1.970 09  | 1.945 85 |
| $n_{1530}$         | 1.529 58  | 1.954 40 |
| $n_{1129}$         | 1.128 64  | 1.963 80 |
| $n_t$              | 1.013 98  | 1.967 56 |
| $n_s$              | 0.852 11  | 1.974 88 |
| $n_{A'}$           | 0.768 19  | 1.980 35 |
| $n_F$              | 0.706 52  | 1.985 61 |
| $n_C$              | 0.656 27  | 1.991 05 |
| $n_{C'}$           | 0.643 85  | 1.992 60 |
| $n_{He-Ne}$        | 0.632 8   | 1.994 06 |
| $n_D$              | 0.589 29  | 2.000 70 |
| $n_d$              | 0.587 56  | 2.001 00 |
| $n_e$              | 0.546 07  | 2.009 12 |
| $n_F$              | 0.486 13  | 2.025 40 |
| $n_{F'}$           | 0.479 99  | 2.027 49 |
| $n_{He-Cd}$        | 0.441 57  | 2.043 19 |
| $n_g$              | 0.435 835 | 2.046 00 |
| $n_h$              | 0.404 656 | 2.064 24 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.391 406 62E+00 |
| $A_2$                           | 4.392 192 28E-01 |
| $A_3$                           | 2.383 584 67E+00 |
| $B_1$                           | 1.314 675 00E-02 |
| $B_2$                           | 5.532 260 42E-02 |
| $B_3$                           | 1.612 599 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 2.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 131.3 |
| Rigidity Modulus G (GPa) | 50.2  |
| Poisson's Ratio $\sigma$ | 0.307 |
| Knoop Hardness Hk[Class] | 720 7 |
| Abrasion Aa              | 55    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.023 490 |
| $n_C - n_{A'}$      | 0.010 695 |
| $n_d - n_C$         | 0.009 952 |
| $n_e - n_C$         | 0.018 070 |
| $n_g - n_d$         | 0.045 001 |
| $n_g - n_F$         | 0.020 601 |
| $n_h - n_g$         | 0.018 235 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.025 041 |
| $n_e - n_{C'}$      | 0.016 519 |
| $n_{F'} - n_e$      | 0.018 376 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.683 8 |
| $\theta_{C,A'}$              | 0.311 3 |
| $\theta_{d,C}$               | 0.289 7 |
| $\theta_{e,C}$               | 0.526 0 |
| $\theta_{g,d}$               | 1.310 0 |
| $\theta_{g,F}$               | 0.599 7 |
| $\theta_{h,g}$               | 0.530 8 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.717 6 |
| $\theta'_{e,C'}$             | 0.473 4 |
| $\theta'_{F,e}$              | 0.526 6 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.000 4 |
| $\Delta\theta_{C,A'}$ | 0.000 1 |
| $\Delta\theta_{g,d}$  | 0.005 8 |
| $\Delta\theta_{g,F}$  | 0.005 4 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 360 |
| $\lambda_{70}$        | 405  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 393  | $\lambda_{0.05}$ | 358 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.83 | 2.98             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.06             |
| 370                    | 0.31             |
| 380                    | 0.61             |
| 390                    | 0.78             |
| 400                    | 0.86             |
| 420                    | 0.933            |
| 440                    | 0.959            |
| 460                    | 0.973            |
| 480                    | 0.982            |
| 500                    | 0.988            |
| 550                    | 0.996            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.998            |
| 1 800                  | 0.992            |
| 2 000                  | 0.980            |
| 2 200                  | 0.955            |
| 2 400                  | 0.86             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 682   |
| Annealing Point AP (°C)                                          | 718   |
| Transformation Temperature Tg (°C)                               | 727   |
| Yield Point At (°C)                                              | 763   |
| Softening Point SP (°C)                                          | 792   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 76    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 90    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.944 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 62                                             |
| -90 ~ -80                               | 64                                             |
| -80 ~ -70                               | 65                                             |
| -70 ~ -60                               | 66                                             |
| -60 ~ -50                               | 67                                             |
| -50 ~ -40                               | 68                                             |
| -40 ~ -30                               | 70                                             |
| -30 ~ -20                               | 71                                             |
| -20 ~ -10                               | 72                                             |
| -10 ~ 0                                 | 73                                             |
| 0 ~ 10                                  | 74                                             |
| 10 ~ 20                                 | 75                                             |
| 20 ~ 30                                 | 76                                             |
| 30 ~ 40                                 | 77                                             |
| 40 ~ 50                                 | 78                                             |
| 50 ~ 60                                 | 79                                             |
| 60 ~ 70                                 | 80                                             |
| 70 ~ 80                                 | 81                                             |
| 80 ~ 90                                 | 82                                             |
| 90 ~ 100                                | 83                                             |
| 100 ~ 110                               | 84                                             |
| 110 ~ 120                               | 84                                             |
| 120 ~ 130                               | 85                                             |
| 130 ~ 140                               | 86                                             |
| 140 ~ 150                               | 87                                             |
| 150 ~ 160                               | 87                                             |
| 160 ~ 170                               | 88                                             |
| 170 ~ 180                               | 89                                             |
| 180 ~ 190                               | 89                                             |
| 190 ~ 200                               | 90                                             |
| 200 ~ 210                               | 91                                             |
| 210 ~ 220                               | 91                                             |
| 220 ~ 230                               | 92                                             |
| 230 ~ 240                               | 92                                             |
| 240 ~ 250                               | 93                                             |
| 250 ~ 260                               | 93                                             |
| 260 ~ 270                               | 94                                             |
| 270 ~ 280                               | 94                                             |
| 280 ~ 290                               | 94                                             |
| 290 ~ 300                               | 95                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 0.76 |
| Specific Gravity $d$                                     | 5.02 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | 0.7                                                             | 1.0 | 1.7 | 2.0 | 2.1 | 2.5 | 2.9 | 4.0 | 4.2 | 5.5 | 7.2  | - |
| -60 ~ -40                                    | 0.6                                                             | 0.9 | 1.7 | 2.0 | 2.0 | 2.5 | 2.9 | 4.1 | 4.2 | 5.7 | 7.5  | - |
| -40 ~ -20                                    | 0.6                                                             | 1.0 | 1.8 | 2.1 | 2.2 | 2.6 | 3.1 | 4.3 | 4.5 | 6.0 | 7.8  | - |
| -20 ~ 0                                      | 0.7                                                             | 1.2 | 2.0 | 2.3 | 2.4 | 2.8 | 3.3 | 4.6 | 4.8 | 6.3 | 8.2  | - |
| 0 ~ 20                                       | 0.9                                                             | 1.3 | 2.2 | 2.5 | 2.6 | 3.1 | 3.6 | 4.8 | 5.0 | 6.7 | 8.7  | - |
| 20 ~ 40                                      | 1.1                                                             | 1.5 | 2.4 | 2.7 | 2.8 | 3.3 | 4.0 | 5.2 | 5.4 | 7.1 | 9.1  | - |
| 40 ~ 60                                      | 1.3                                                             | 1.7 | 2.6 | 2.9 | 3.0 | 3.6 | 4.2 | 5.6 | 5.8 | 7.5 | 9.6  | - |
| 60 ~ 80                                      | 1.4                                                             | 1.8 | 2.8 | 3.2 | 3.2 | 3.9 | 4.5 | 5.9 | 6.1 | 7.9 | 10.1 | - |
| 80 ~ 100                                     | 1.6                                                             | 2.1 | 3.1 | 3.4 | 3.5 | 4.1 | 4.7 | 6.1 | 6.3 | 8.4 | 10.6 | - |
| 100 ~ 120                                    | 1.7                                                             | 2.2 | 3.3 | 3.6 | 3.7 | 4.4 | 5.0 | 6.4 | 6.7 | 8.6 | 11.0 | - |
| 120 ~ 140                                    | 1.8                                                             | 2.4 | 3.4 | 3.8 | 3.9 | 4.6 | 5.2 | 6.7 | 6.9 | 9.0 | 11.4 | - |
| 140 ~ 160                                    | 1.9                                                             | 2.4 | 3.5 | 3.9 | 4.1 | 4.7 | 5.4 | 7.0 | 7.2 | 9.3 | 11.8 | - |
| 160 ~ 180                                    | 2.0                                                             | 2.5 | 3.6 | 4.0 | 4.1 | 4.8 | 5.5 | 7.1 | 7.4 | 9.6 | 12.2 | - |

## S-LAL 7Q

Code(d) **652585**  
Code(e) **654584**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.651 60</b><br>1.651 600 | Abbe Number $\nu_d$ | <b>58.54</b> | Dispersion $n_F - n_C$       | <b>0.011 130</b> |
| Refractive Index $n_e$ | 1.654 255                    | Abbe Number $\nu_e$ | 58.34        | Dispersion $n_{F'} - n_{C'}$ | 0.011 215        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.615 23 |
| $n_{1970}$         | 1.970 09  | 1.622 65 |
| $n_{1530}$         | 1.529 58  | 1.630 34 |
| $n_{1129}$         | 1.128 64  | 1.636 71 |
| $n_t$              | 1.013 98  | 1.638 70 |
| $n_s$              | 0.852 11  | 1.642 04 |
| $n_{A'}$           | 0.768 19  | 1.644 25 |
| $n_F$              | 0.706 52  | 1.646 24 |
| $n_C$              | 0.656 27  | 1.648 19 |
| $n_{C'}$           | 0.643 85  | 1.648 74 |
| $n_{He-Ne}$        | 0.632 8   | 1.649 24 |
| $n_D$              | 0.589 29  | 1.651 50 |
| $n_d$              | 0.587 56  | 1.651 60 |
| $n_e$              | 0.546 07  | 1.654 26 |
| $n_F$              | 0.486 13  | 1.659 32 |
| $n_{F'}$           | 0.479 99  | 1.659 95 |
| $n_{He-Cd}$        | 0.441 57  | 1.664 53 |
| $n_g$              | 0.435 835 | 1.665 32 |
| $n_h$              | 0.404 656 | 1.670 29 |
| $n_i$              | 0.365 015 | 1.678 73 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.052 771 43E-01 |
| $A_2$                           | 7.779 556 84E-01 |
| $A_3$                           | 1.181 372 86E+00 |
| $B_1$                           | 1.556 065 07E-02 |
| $B_2$                           | 2.847 186 26E-03 |
| $B_3$                           | 8.807 379 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 2    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 52.0 |
| Phosphate Resistance PR                   | 4.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 110.8 |
| Rigidity Modulus G (GPa) | 43.3  |
| Poisson's Ratio $\sigma$ | 0.280 |
| Knoop Hardness Hk[Class] | 680   |
| Abrasion Aa              | 75    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.009 488 |
| $n_C - n_{A'}$      | 0.003 943 |
| $n_d - n_C$         | 0.003 408 |
| $n_e - n_C$         | 0.006 063 |
| $n_g - n_d$         | 0.013 721 |
| $n_g - n_F$         | 0.005 999 |
| $n_h - n_g$         | 0.004 966 |
| $n_i - n_g$         | 0.013 410 |
| $n_{C'} - n_t$      | 0.010 033 |
| $n_e - n_{C'}$      | 0.005 518 |
| $n_{F'} - n_e$      | 0.005 697 |
| $n_i - n_{F'}$      | 0.018 779 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.852 5 |
| $\theta_{C,A'}$              | 0.354 3 |
| $\theta_{d,C}$               | 0.306 2 |
| $\theta_{e,C}$               | 0.544 7 |
| $\theta_{g,d}$               | 1.232 8 |
| $\theta_{g,F}$               | 0.539 0 |
| $\theta_{h,g}$               | 0.446 2 |
| $\theta_{i,g}$               | 1.204 9 |
| $\theta'_{C,t}$              | 0.894 6 |
| $\theta'_{e,C'}$             | 0.492 0 |
| $\theta'_{F,e}$              | 0.508 0 |
| $\theta'_{i,F'}$             | 1.674 5 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.031 2  |
| $\Delta\theta_{C,A'}$ | 0.007 5  |
| $\Delta\theta_{g,d}$  | -0.010 3 |
| $\Delta\theta_{g,F}$  | -0.007 8 |
| $\Delta\theta_{i,g}$  | -0.029 9 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 365  | $\lambda_5$      |     |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 351  | $\lambda_{0.05}$ | 294 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.32 | 0.29             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.01             |
| 290                    | 0.03             |
| 300                    | 0.08             |
| 310                    | 0.19             |
| 320                    | 0.34             |
| 330                    | 0.51             |
| 340                    | 0.67             |
| 350                    | 0.79             |
| 360                    | 0.88             |
| 370                    | 0.930            |
| 380                    | 0.960            |
| 390                    | 0.974            |
| 400                    | 0.983            |
| 420                    | 0.990            |
| 440                    | 0.993            |
| 460                    | 0.995            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.984            |
| 1 600                  | 0.989            |
| 1 800                  | 0.977            |
| 2 000                  | 0.948            |
| 2 200                  | 0.83             |
| 2 400                  | 0.59             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 580   |
| Annealing Point AP (°C)                                          | 601   |
| Transformation Temperature Tg (°C)                               | 619   |
| Yield Point At (°C)                                              | 656   |
| Softening Point SP (°C)                                          | 683   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 58    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 73    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.989 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 45                                             |
| -90 ~ -80                               | 47                                             |
| -80 ~ -70                               | 48                                             |
| -70 ~ -60                               | 49                                             |
| -60 ~ -50                               | 50                                             |
| -50 ~ -40                               | 51                                             |
| -40 ~ -30                               | 52                                             |
| -30 ~ -20                               | 53                                             |
| -20 ~ -10                               | 55                                             |
| -10 ~ 0                                 | 56                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 60                                             |
| 40 ~ 50                                 | 61                                             |
| 50 ~ 60                                 | 62                                             |
| 60 ~ 70                                 | 63                                             |
| 70 ~ 80                                 | 63                                             |
| 80 ~ 90                                 | 64                                             |
| 90 ~ 100                                | 65                                             |
| 100 ~ 110                               | 66                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 68                                             |
| 140 ~ 150                               | 69                                             |
| 150 ~ 160                               | 70                                             |
| 160 ~ 170                               | 71                                             |
| 170 ~ 180                               | 71                                             |
| 180 ~ 190                               | 72                                             |
| 190 ~ 200                               | 73                                             |
| 200 ~ 210                               | 73                                             |
| 210 ~ 220                               | 74                                             |
| 220 ~ 230                               | 75                                             |
| 230 ~ 240                               | 75                                             |
| 240 ~ 250                               | 76                                             |
| 250 ~ 260                               | 76                                             |
| 260 ~ 270                               | 77                                             |
| 270 ~ 280                               | 78                                             |
| 280 ~ 290                               | 78                                             |
| 290 ~ 300                               | 79                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.98 |
| Specific Gravity $d$                                     | 3.24 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.9                                                             | 3.1 | 3.3 | 3.4 | 3.4 | 3.5 | 3.6 | 3.9 | 4.0 | 4.2 | 4.5 | 5.0 |
| -60 ~ -40                                    | 2.9                                                             | 3.0 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.8 | 3.8 | 4.1 | 4.4 | 4.9 |
| -40 ~ -20                                    | 2.9                                                             | 3.0 | 3.2 | 3.2 | 3.3 | 3.4 | 3.5 | 3.8 | 3.9 | 4.1 | 4.4 | 4.9 |
| -20 ~ 0                                      | 2.9                                                             | 3.1 | 3.3 | 3.4 | 3.4 | 3.5 | 3.6 | 3.8 | 3.9 | 4.3 | 4.5 | 5.1 |
| 0 ~ 20                                       | 3.0                                                             | 3.1 | 3.3 | 3.4 | 3.4 | 3.7 | 3.8 | 4.0 | 4.1 | 4.4 | 4.6 | 5.2 |
| 20 ~ 40                                      | 3.1                                                             | 3.2 | 3.5 | 3.5 | 3.6 | 3.7 | 3.8 | 4.2 | 4.2 | 4.5 | 4.8 | 5.4 |
| 40 ~ 60                                      | 3.2                                                             | 3.3 | 3.7 | 3.8 | 3.8 | 3.9 | 4.0 | 4.3 | 4.3 | 4.7 | 5.0 | 5.6 |
| 60 ~ 80                                      | 3.3                                                             | 3.5 | 3.8 | 3.8 | 3.9 | 4.0 | 4.1 | 4.4 | 4.4 | 4.9 | 5.2 | 5.8 |
| 80 ~ 100                                     | 3.5                                                             | 3.6 | 3.9 | 4.0 | 4.0 | 4.2 | 4.3 | 4.6 | 4.6 | 5.0 | 5.3 | 6.0 |
| 100 ~ 120                                    | 3.6                                                             | 3.7 | 4.0 | 4.1 | 4.1 | 4.3 | 4.4 | 4.7 | 4.7 | 5.1 | 5.4 | 6.1 |
| 120 ~ 140                                    | 3.6                                                             | 3.8 | 4.1 | 4.2 | 4.2 | 4.4 | 4.5 | 4.8 | 4.9 | 5.2 | 5.6 | 6.3 |
| 140 ~ 160                                    | 3.7                                                             | 3.9 | 4.2 | 4.3 | 4.3 | 4.5 | 4.6 | 5.0 | 5.0 | 5.3 | 5.8 | 6.5 |
| 160 ~ 180                                    | 3.8                                                             | 4.0 | 4.3 | 4.4 | 4.4 | 4.6 | 4.8 | 5.1 | 5.1 | 5.5 | 5.9 | 6.6 |

OHARA 25-04

## S-LAL 8

Code(d) 713539

Code(e) 716536

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.713 00<br>1.712 995 | Abbe Number $\nu_d$ | 53.87 | Dispersion $n_F - n_C$       | 0.013 236 |
| Refractive Index $n_e$ | 1.716 150             | Abbe Number $\nu_e$ | 53.64 | Dispersion $n_{F'} - n_{C'}$ | 0.013 352 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.674 18 |
| $n_{1970}$         | 1.970 09  | 1.681 55 |
| $n_{1530}$         | 1.529 58  | 1.689 30 |
| $n_{1129}$         | 1.128 64  | 1.695 97 |
| $n_t$              | 1.013 98  | 1.698 13 |
| $n_s$              | 0.852 11  | 1.701 86 |
| $n_{A'}$           | 0.768 19  | 1.704 38 |
| $n_F$              | 0.706 52  | 1.706 69 |
| $n_C$              | 0.656 27  | 1.708 97 |
| $n_{C'}$           | 0.643 85  | 1.709 61 |
| $n_{He-Ne}$        | 0.632 8   | 1.710 21 |
| $n_D$              | 0.589 29  | 1.712 88 |
| $n_d$              | 0.587 56  | 1.713 00 |
| $n_e$              | 0.546 07  | 1.716 15 |
| $n_F$              | 0.486 13  | 1.722 21 |
| $n_{F'}$           | 0.479 99  | 1.722 97 |
| $n_{He-Cd}$        | 0.441 57  | 1.728 48 |
| $n_g$              | 0.435 835 | 1.729 43 |
| $n_h$              | 0.404 656 | 1.735 45 |
| $n_i$              | 0.365 015 | 1.745 75 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.306 632 91E+00 |
| $A_2$                           | 5.713 772 53E-01 |
| $A_3$                           | 1.243 036 05E+00 |
| $B_1$                           | 6.118 624 48E-03 |
| $B_2$                           | 2.127 214 70E-02 |
| $B_3$                           | 9.062 856 86E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 52.0 |
| Phosphate Resistance PR                   | 3.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 114.0 |
| Rigidity Modulus G (GPa) | 44.2  |
| Poisson's Ratio $\sigma$ | 0.289 |
| Knoop Hardness Hk[Class] | 670 7 |
| Abrasion Aa              | 81    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 846 |
| $n_C - n_{A'}$      | 0.004 591 |
| $n_d - n_C$         | 0.004 021 |
| $n_e - n_C$         | 0.007 176 |
| $n_g - n_d$         | 0.016 440 |
| $n_g - n_F$         | 0.007 225 |
| $n_h - n_g$         | 0.006 016 |
| $n_i - n_g$         | 0.016 311 |
| $n_{C'} - n_t$      | 0.011 486 |
| $n_e - n_{C'}$      | 0.006 536 |
| $n_{F'} - n_e$      | 0.006 816 |
| $n_i - n_{F'}$      | 0.022 780 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.819 4 |
| $\theta_{C,A'}$              | 0.346 9 |
| $\theta_{d,C}$               | 0.303 8 |
| $\theta_{e,C}$               | 0.542 2 |
| $\theta_{g,d}$               | 1.242 1 |
| $\theta_{g,F}$               | 0.545 9 |
| $\theta_{h,g}$               | 0.454 5 |
| $\theta_{i,g}$               | 1.232 3 |
| $\theta'_{C,t}$              | 0.860 2 |
| $\theta'_{e,C'}$             | 0.489 5 |
| $\theta'_{F,e}$              | 0.510 5 |
| $\theta'_{i,F'}$             | 1.706 1 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.020 0  |
| $\Delta\theta_{C,A'}$ | 0.005 7  |
| $\Delta\theta_{g,d}$  | -0.010 7 |
| $\Delta\theta_{g,F}$  | -0.008 4 |
| $\Delta\theta_{i,g}$  | -0.041 6 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 375  | $\lambda_5$      | 295 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 356  | $\lambda_{0.05}$ | 295 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.42 | 0.39             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    | 0.03             |
| 300                    | 0.07             |
| 310                    | 0.15             |
| 320                    | 0.28             |
| 330                    | 0.44             |
| 340                    | 0.60             |
| 350                    | 0.74             |
| 360                    | 0.84             |
| 370                    | 0.905            |
| 380                    | 0.944            |
| 390                    | 0.965            |
| 400                    | 0.977            |
| 420                    | 0.988            |
| 440                    | 0.991            |
| 460                    | 0.994            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.996            |
| 650                    | 0.997            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.991            |
| 1 600                  | 0.991            |
| 1 800                  | 0.981            |
| 2 000                  | 0.955            |
| 2 200                  | 0.87             |
| 2 400                  | 0.62             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 590   |
| Annealing Point AP (°C)                                          | 617   |
| Transformation Temperature Tg (°C)                               | 627   |
| Yield Point At (°C)                                              | 665   |
| Softening Point SP (°C)                                          | 698   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 62    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 77    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.894 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 48                                             |
| -90 ~ -80                               | 50                                             |
| -80 ~ -70                               | 51                                             |
| -70 ~ -60                               | 52                                             |
| -60 ~ -50                               | 54                                             |
| -50 ~ -40                               | 55                                             |
| -40 ~ -30                               | 56                                             |
| -30 ~ -20                               | 57                                             |
| -20 ~ -10                               | 58                                             |
| -10 ~ 0                                 | 59                                             |
| 0 ~ 10                                  | 61                                             |
| 10 ~ 20                                 | 62                                             |
| 20 ~ 30                                 | 63                                             |
| 30 ~ 40                                 | 64                                             |
| 40 ~ 50                                 | 65                                             |
| 50 ~ 60                                 | 66                                             |
| 60 ~ 70                                 | 67                                             |
| 70 ~ 80                                 | 68                                             |
| 80 ~ 90                                 | 69                                             |
| 90 ~ 100                                | 69                                             |
| 100 ~ 110                               | 70                                             |
| 110 ~ 120                               | 71                                             |
| 120 ~ 130                               | 72                                             |
| 130 ~ 140                               | 73                                             |
| 140 ~ 150                               | 74                                             |
| 150 ~ 160                               | 74                                             |
| 160 ~ 170                               | 75                                             |
| 170 ~ 180                               | 76                                             |
| 180 ~ 190                               | 76                                             |
| 190 ~ 200                               | 77                                             |
| 200 ~ 210                               | 78                                             |
| 210 ~ 220                               | 78                                             |
| 220 ~ 230                               | 79                                             |
| 230 ~ 240                               | 79                                             |
| 240 ~ 250                               | 80                                             |
| 250 ~ 260                               | 80                                             |
| 260 ~ 270                               | 81                                             |
| 270 ~ 280                               | 81                                             |
| 280 ~ 290                               | 82                                             |
| 290 ~ 300                               | 82                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.75 |
| Specific Gravity $d$                                     | 3.79 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.5                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.2 | 3.4 | 3.7 | 3.8 | 4.1 | 4.4 | 5.2 |
| -60 ~ -40                                    | 2.5                                                             | 2.6 | 2.9 | 3.1 | 3.1 | 3.2 | 3.4 | 3.6 | 3.7 | 4.0 | 4.5 | 5.1 |
| -40 ~ -20                                    | 2.4                                                             | 2.6 | 2.9 | 3.0 | 3.0 | 3.2 | 3.3 | 3.7 | 3.8 | 4.1 | 4.4 | 5.1 |
| -20 ~ 0                                      | 2.5                                                             | 2.7 | 3.0 | 3.1 | 3.2 | 3.3 | 3.5 | 3.8 | 3.8 | 4.2 | 4.5 | 5.3 |
| 0 ~ 20                                       | 2.7                                                             | 2.8 | 3.1 | 3.2 | 3.2 | 3.4 | 3.5 | 3.9 | 3.9 | 4.4 | 4.7 | 5.4 |
| 20 ~ 40                                      | 2.8                                                             | 3.0 | 3.3 | 3.4 | 3.4 | 3.5 | 3.7 | 4.0 | 4.1 | 4.4 | 4.8 | 5.6 |
| 40 ~ 60                                      | 2.9                                                             | 3.1 | 3.4 | 3.5 | 3.5 | 3.7 | 3.8 | 4.1 | 4.2 | 4.6 | 5.1 | 5.8 |
| 60 ~ 80                                      | 3.0                                                             | 3.1 | 3.5 | 3.6 | 3.7 | 3.8 | 4.0 | 4.3 | 4.4 | 4.8 | 5.2 | 5.9 |
| 80 ~ 100                                     | 3.1                                                             | 3.3 | 3.6 | 3.7 | 3.7 | 3.9 | 4.1 | 4.5 | 4.5 | 4.9 | 5.3 | 6.1 |
| 100 ~ 120                                    | 3.2                                                             | 3.4 | 3.7 | 3.8 | 3.8 | 4.0 | 4.2 | 4.5 | 4.6 | 5.1 | 5.5 | 6.3 |
| 120 ~ 140                                    | 3.3                                                             | 3.4 | 3.8 | 3.9 | 3.9 | 4.1 | 4.2 | 4.7 | 4.7 | 5.2 | 5.6 | 6.4 |
| 140 ~ 160                                    | 3.3                                                             | 3.5 | 3.9 | 4.0 | 4.0 | 4.2 | 4.4 | 4.7 | 4.8 | 5.2 | 5.6 | 6.4 |
| 160 ~ 180                                    | 3.4                                                             | 3.5 | 3.9 | 4.0 | 4.0 | 4.2 | 4.4 | 4.8 | 4.8 | 5.2 | 5.7 | 6.5 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.691 00<br>1.691 002 | Abbe Number $\nu_d$ | 54.82 | Dispersion $n_F - n_C$       | 0.012 605 |
| Refractive Index $n_e$ | 1.694 007             | Abbe Number $\nu_e$ | 54.59 | Dispersion $n_{F'} - n_{C'}$ | 0.012 714 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.653 43 |
| $n_{1970}$         | 1.970 09  | 1.660 64 |
| $n_{1530}$         | 1.529 58  | 1.668 22 |
| $n_{1129}$         | 1.128 64  | 1.674 70 |
| $n_t$              | 1.013 98  | 1.676 78 |
| $n_s$              | 0.852 11  | 1.680 37 |
| $n_{A'}$           | 0.768 19  | 1.682 79 |
| $n_F$              | 0.706 52  | 1.684 99 |
| $n_C$              | 0.656 27  | 1.687 17 |
| $n_{C'}$           | 0.643 85  | 1.687 78 |
| $n_{\text{He-Ne}}$ | 0.632 8   | 1.688 35 |
| $n_D$              | 0.589 29  | 1.690 89 |
| $n_d$              | 0.587 56  | 1.691 00 |
| $n_e$              | 0.546 07  | 1.694 01 |
| $n_F$              | 0.486 13  | 1.699 77 |
| $n_{F'}$           | 0.479 99  | 1.700 49 |
| $n_{\text{He-Cd}}$ | 0.441 57  | 1.705 73 |
| $n_g$              | 0.435 835 | 1.706 64 |
| $n_h$              | 0.404 656 | 1.712 36 |
| $n_i$              | 0.365 015 | 1.722 12 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.161 956 87E+00 |
| $A_2$                           | 6.448 600 99E-01 |
| $A_3$                           | 1.250 622 21E+00 |
| $B_1$                           | 1.596 595 09E-02 |
| $B_2$                           | 5.055 024 67E-04 |
| $B_3$                           | 9.382 841 69E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 52.0 |
| Phosphate Resistance PR                   | 4.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 107.5 |
| Rigidity Modulus G (GPa) | 41.8  |
| Poisson's Ratio $\sigma$ | 0.287 |
| Knoop Hardness Hk[Class] | 660 7 |
| Abrasion Aa              | 89    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 384 |
| $n_C - n_{A'}$      | 0.004 384 |
| $n_d - n_C$         | 0.003 833 |
| $n_e - n_C$         | 0.006 838 |
| $n_g - n_d$         | 0.015 640 |
| $n_g - n_F$         | 0.006 868 |
| $n_h - n_g$         | 0.005 714 |
| $n_i - n_g$         | 0.015 476 |
| $n_{C'} - n_t$      | 0.010 994 |
| $n_e - n_{C'}$      | 0.006 228 |
| $n_{F'} - n_e$      | 0.006 486 |
| $n_i - n_{F'}$      | 0.021 625 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.823 8 |
| $\theta_{C,A'}$              | 0.347 8 |
| $\theta_{d,C}$               | 0.304 1 |
| $\theta_{e,C}$               | 0.542 5 |
| $\theta_{g,d}$               | 1.240 8 |
| $\theta_{g,F}$               | 0.544 9 |
| $\theta_{h,g}$               | 0.453 3 |
| $\theta_{i,g}$               | 1.227 8 |
| $\theta'_{C,t}$              | 0.864 7 |
| $\theta'_{e,C'}$             | 0.489 9 |
| $\theta'_{F,e}$              | 0.510 1 |
| $\theta'_{i,F'}$             | 1.700 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.019 9  |
| $\Delta\theta_{C,A'}$ | 0.005 5  |
| $\Delta\theta_{g,d}$  | -0.010 1 |
| $\Delta\theta_{g,F}$  | -0.007 9 |
| $\Delta\theta_{i,g}$  | -0.038 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 375  | $\lambda_5$      | 295 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 358  | $\lambda_{0.05}$ | 301 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.51 | 0.52             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    | 0.01             |
| 300                    | 0.04             |
| 310                    | 0.11             |
| 320                    | 0.22             |
| 330                    | 0.38             |
| 340                    | 0.55             |
| 350                    | 0.70             |
| 360                    | 0.82             |
| 370                    | 0.89             |
| 380                    | 0.936            |
| 390                    | 0.960            |
| 400                    | 0.973            |
| 420                    | 0.985            |
| 440                    | 0.988            |
| 460                    | 0.992            |
| 480                    | 0.994            |
| 500                    | 0.995            |
| 550                    | 0.997            |
| 600                    | 0.996            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.997            |
| 1 000                  | 0.996            |
| 1 200                  | 0.996            |
| 1 400                  | 0.992            |
| 1 600                  | 0.992            |
| 1 800                  | 0.984            |
| 2 000                  | 0.963            |
| 2 200                  | 0.89             |
| 2 400                  | 0.66             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 606   |
| Annealing Point AP (°C)                                          | 630   |
| Transformation Temperature Tg (°C)                               | 649   |
| Yield Point At (°C)                                              | 681   |
| Softening Point SP (°C)                                          | 707   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 61    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 73    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.895 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 50                                             |
| -90 ~ -80                               | 51                                             |
| -80 ~ -70                               | 52                                             |
| -70 ~ -60                               | 53                                             |
| -60 ~ -50                               | 54                                             |
| -50 ~ -40                               | 55                                             |
| -40 ~ -30                               | 56                                             |
| -30 ~ -20                               | 57                                             |
| -20 ~ -10                               | 57                                             |
| -10 ~ 0                                 | 58                                             |
| 0 ~ 10                                  | 59                                             |
| 10 ~ 20                                 | 60                                             |
| 20 ~ 30                                 | 61                                             |
| 30 ~ 40                                 | 62                                             |
| 40 ~ 50                                 | 62                                             |
| 50 ~ 60                                 | 63                                             |
| 60 ~ 70                                 | 64                                             |
| 70 ~ 80                                 | 65                                             |
| 80 ~ 90                                 | 66                                             |
| 90 ~ 100                                | 66                                             |
| 100 ~ 110                               | 67                                             |
| 110 ~ 120                               | 68                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 69                                             |
| 140 ~ 150                               | 70                                             |
| 150 ~ 160                               | 71                                             |
| 160 ~ 170                               | 71                                             |
| 170 ~ 180                               | 72                                             |
| 180 ~ 190                               | 73                                             |
| 190 ~ 200                               | 73                                             |
| 200 ~ 210                               | 74                                             |
| 210 ~ 220                               | 75                                             |
| 220 ~ 230                               | 75                                             |
| 230 ~ 240                               | 76                                             |
| 240 ~ 250                               | 76                                             |
| 250 ~ 260                               | 77                                             |
| 260 ~ 270                               | 78                                             |
| 270 ~ 280                               | 78                                             |
| 280 ~ 290                               | 79                                             |
| 290 ~ 300                               | 79                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.85 |
| Specific Gravity $d$                                     | 3.63 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.7                                                             | 2.8 | 3.1 | 3.2 | 3.2 | 3.4 | 3.5 | 3.7 | 3.8 | 4.2 | 4.4 | 5.0 |
| -60 ~ -40                                    | 2.6                                                             | 2.7 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.7 | 3.7 | 4.0 | 4.3 | 4.9 |
| -40 ~ -20                                    | 2.4                                                             | 2.7 | 3.0 | 3.0 | 3.1 | 3.2 | 3.3 | 3.6 | 3.7 | 4.0 | 4.4 | 5.0 |
| -20 ~ 0                                      | 2.5                                                             | 2.6 | 2.9 | 3.0 | 3.0 | 3.3 | 3.4 | 3.7 | 3.8 | 4.1 | 4.4 | 5.2 |
| 0 ~ 20                                       | 2.5                                                             | 2.8 | 3.1 | 3.2 | 3.2 | 3.4 | 3.5 | 3.8 | 3.9 | 4.2 | 4.6 | 5.3 |
| 20 ~ 40                                      | 2.6                                                             | 2.8 | 3.2 | 3.3 | 3.3 | 3.5 | 3.7 | 4.0 | 4.0 | 4.4 | 4.8 | 5.5 |
| 40 ~ 60                                      | 2.8                                                             | 3.0 | 3.3 | 3.4 | 3.5 | 3.6 | 3.8 | 4.1 | 4.2 | 4.6 | 5.0 | 5.8 |
| 60 ~ 80                                      | 2.9                                                             | 3.1 | 3.4 | 3.5 | 3.6 | 3.8 | 4.0 | 4.4 | 4.4 | 4.8 | 5.2 | 5.9 |
| 80 ~ 100                                     | 3.0                                                             | 3.2 | 3.6 | 3.7 | 3.7 | 3.9 | 4.1 | 4.5 | 4.5 | 5.0 | 5.5 | 6.2 |
| 100 ~ 120                                    | 3.2                                                             | 3.4 | 3.7 | 3.9 | 3.9 | 4.1 | 4.3 | 4.7 | 4.7 | 5.2 | 5.7 | 6.5 |
| 120 ~ 140                                    | 3.3                                                             | 3.5 | 3.9 | 4.0 | 4.0 | 4.2 | 4.4 | 4.8 | 4.9 | 5.3 | 5.9 | 6.7 |
| 140 ~ 160                                    | 3.4                                                             | 3.6 | 4.1 | 4.2 | 4.3 | 4.5 | 4.7 | 5.1 | 5.1 | 5.6 | 6.1 | 6.9 |
| 160 ~ 180                                    | 3.5                                                             | 3.8 | 4.2 | 4.3 | 4.4 | 4.6 | 4.8 | 5.2 | 5.3 | 5.7 | 6.2 | 7.1 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.720 00<br>1.719 995 | Abbe Number $\nu_d$ | 50.23 | Dispersion $n_F - n_C$       | 0.014 334 |
| Refractive Index $n_e$ | 1.723 409             | Abbe Number $\nu_e$ | 49.98 | Dispersion $n_{F'} - n_{C'}$ | 0.014 474 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.681 59 |
| $n_{1970}$         | 1.970 09  | 1.688 41 |
| $n_{1530}$         | 1.529 58  | 1.695 67 |
| $n_{1129}$         | 1.128 64  | 1.702 13 |
| $n_t$              | 1.013 98  | 1.704 30 |
| $n_s$              | 0.852 11  | 1.708 14 |
| $n_{A'}$           | 0.768 19  | 1.710 79 |
| $n_F$              | 0.706 52  | 1.713 23 |
| $n_C$              | 0.656 27  | 1.715 67 |
| $n_{C'}$           | 0.643 85  | 1.716 36 |
| $n_{He-Ne}$        | 0.632 8   | 1.717 00 |
| $n_D$              | 0.589 29  | 1.719 87 |
| $n_d$              | 0.587 56  | 1.720 00 |
| $n_e$              | 0.546 07  | 1.723 41 |
| $n_F$              | 0.486 13  | 1.730 00 |
| $n_{F'}$           | 0.479 99  | 1.730 83 |
| $n_{He-Cd}$        | 0.441 57  | 1.736 86 |
| $n_g$              | 0.435 835 | 1.737 92 |
| $n_h$              | 0.404 656 | 1.744 55 |
| $n_i$              | 0.365 015 | 1.755 97 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.528 125 75E+00 |
| $A_2$                           | 3.679 652 67E-01 |
| $A_3$                           | 1.117 517 84E+00 |
| $B_1$                           | 7.768 176 44E-03 |
| $B_2$                           | 2.720 265 48E-02 |
| $B_3$                           | 8.886 974 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 3.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 106.1 |
| Rigidity Modulus G (GPa) | 41.0  |
| Poisson's Ratio $\sigma$ | 0.294 |
| Knoop Hardness Hk[Class] | 640 6 |
| Abrasion Aa              | 89    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 368 |
| $n_C - n_{A'}$      | 0.004 885 |
| $n_d - n_C$         | 0.004 325 |
| $n_e - n_C$         | 0.007 739 |
| $n_g - n_d$         | 0.017 923 |
| $n_g - n_F$         | 0.007 914 |
| $n_h - n_g$         | 0.006 628 |
| $n_i - n_g$         | 0.018 051 |
| $n_{C'} - n_t$      | 0.012 054 |
| $n_e - n_{C'}$      | 0.007 053 |
| $n_{F'} - n_e$      | 0.007 421 |
| $n_i - n_{F'}$      | 0.025 139 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.793 1 |
| $\theta_{C,A'}$              | 0.340 8 |
| $\theta_{d,C}$               | 0.301 7 |
| $\theta_{e,C}$               | 0.539 9 |
| $\theta_{g,d}$               | 1.250 4 |
| $\theta_{g,F}$               | 0.552 1 |
| $\theta_{h,g}$               | 0.462 4 |
| $\theta_{i,g}$               | 1.259 3 |
| $\theta'_{C,t}$              | 0.832 8 |
| $\theta'_{e,C'}$             | 0.487 3 |
| $\theta'_{F',e}$             | 0.512 7 |
| $\theta'_{i,F'}$             | 1.736 8 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.010 7  |
| $\Delta\theta_{C,A'}$ | 0.004 0  |
| $\Delta\theta_{g,d}$  | -0.010 0 |
| $\Delta\theta_{g,F}$  | -0.008 1 |
| $\Delta\theta_{i,g}$  | -0.045 1 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 380  | $\lambda_5$      | 310 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 357  | $\lambda_{0.05}$ | 309 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.59 | 0.60             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.07             |
| 320                    | 0.22             |
| 330                    | 0.40             |
| 340                    | 0.58             |
| 350                    | 0.72             |
| 360                    | 0.83             |
| 370                    | 0.89             |
| 380                    | 0.937            |
| 390                    | 0.959            |
| 400                    | 0.972            |
| 420                    | 0.983            |
| 440                    | 0.988            |
| 460                    | 0.991            |
| 480                    | 0.994            |
| 500                    | 0.996            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.990            |
| 2 000                  | 0.971            |
| 2 200                  | 0.922            |
| 2 400                  | 0.71             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 582   |
| Annealing Point AP (°C)                                          | 600   |
| Transformation Temperature Tg (°C)                               | 628   |
| Yield Point At (°C)                                              | 658   |
| Softening Point SP (°C)                                          | 692   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 62    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 76    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.850 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 48                                             |
| -90 ~ -80                               | 50                                             |
| -80 ~ -70                               | 51                                             |
| -70 ~ -60                               | 52                                             |
| -60 ~ -50                               | 54                                             |
| -50 ~ -40                               | 55                                             |
| -40 ~ -30                               | 56                                             |
| -30 ~ -20                               | 57                                             |
| -20 ~ -10                               | 58                                             |
| -10 ~ 0                                 | 59                                             |
| 0 ~ 10                                  | 60                                             |
| 10 ~ 20                                 | 61                                             |
| 20 ~ 30                                 | 63                                             |
| 30 ~ 40                                 | 64                                             |
| 40 ~ 50                                 | 64                                             |
| 50 ~ 60                                 | 65                                             |
| 60 ~ 70                                 | 66                                             |
| 70 ~ 80                                 | 67                                             |
| 80 ~ 90                                 | 68                                             |
| 90 ~ 100                                | 69                                             |
| 100 ~ 110                               | 70                                             |
| 110 ~ 120                               | 71                                             |
| 120 ~ 130                               | 71                                             |
| 130 ~ 140                               | 72                                             |
| 140 ~ 150                               | 73                                             |
| 150 ~ 160                               | 74                                             |
| 160 ~ 170                               | 74                                             |
| 170 ~ 180                               | 75                                             |
| 180 ~ 190                               | 76                                             |
| 190 ~ 200                               | 76                                             |
| 200 ~ 210                               | 77                                             |
| 210 ~ 220                               | 77                                             |
| 220 ~ 230                               | 78                                             |
| 230 ~ 240                               | 78                                             |
| 240 ~ 250                               | 79                                             |
| 250 ~ 260                               | 79                                             |
| 260 ~ 270                               | 80                                             |
| 270 ~ 280                               | 80                                             |
| 280 ~ 290                               | 80                                             |
| 290 ~ 300                               | 81                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.17 |
| Specific Gravity $d$                                     | 3.86 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 3.5                                                             | 3.7 | 4.0 | 4.1 | 4.1 | 4.3 | 4.5 | 4.8 | 4.9 | 5.3 | 5.8 | 6.6 |
| -60 ~ -40                                    | 3.4                                                             | 3.5 | 3.9 | 4.1 | 4.1 | 4.3 | 4.4 | 4.8 | 4.8 | 5.2 | 5.8 | 6.6 |
| -40 ~ -20                                    | 3.4                                                             | 3.6 | 3.9 | 4.0 | 4.1 | 4.2 | 4.4 | 4.9 | 4.9 | 5.4 | 5.8 | 6.7 |
| -20 ~ 0                                      | 3.4                                                             | 3.7 | 4.1 | 4.2 | 4.2 | 4.4 | 4.6 | 4.9 | 5.0 | 5.4 | 6.0 | 6.9 |
| 0 ~ 20                                       | 3.6                                                             | 3.8 | 4.1 | 4.2 | 4.3 | 4.5 | 4.6 | 5.0 | 5.1 | 5.6 | 6.1 | 7.0 |
| 20 ~ 40                                      | 3.7                                                             | 3.9 | 4.3 | 4.4 | 4.4 | 4.6 | 4.8 | 5.2 | 5.3 | 5.7 | 6.3 | 7.3 |
| 40 ~ 60                                      | 3.8                                                             | 4.0 | 4.4 | 4.5 | 4.6 | 4.8 | 5.0 | 5.4 | 5.4 | 6.0 | 6.5 | 7.5 |
| 60 ~ 80                                      | 3.9                                                             | 4.2 | 4.6 | 4.7 | 4.7 | 4.9 | 5.2 | 5.6 | 5.6 | 6.1 | 6.6 | 7.6 |
| 80 ~ 100                                     | 4.0                                                             | 4.2 | 4.6 | 4.7 | 4.8 | 5.0 | 5.3 | 5.7 | 5.8 | 6.3 | 6.8 | 7.8 |
| 100 ~ 120                                    | 4.1                                                             | 4.3 | 4.7 | 4.9 | 4.9 | 5.1 | 5.3 | 5.9 | 5.9 | 6.4 | 7.0 | 8.0 |
| 120 ~ 140                                    | 4.2                                                             | 4.4 | 4.8 | 4.9 | 5.0 | 5.3 | 5.4 | 6.0 | 6.0 | 6.6 | 7.1 | 8.2 |
| 140 ~ 160                                    | 4.2                                                             | 4.4 | 4.9 | 5.1 | 5.1 | 5.3 | 5.5 | 6.0 | 6.1 | 6.6 | 7.2 | 8.3 |
| 160 ~ 180                                    | 4.3                                                             | 4.5 | 4.9 | 5.1 | 5.1 | 5.3 | 5.6 | 6.0 | 6.1 | 6.7 | 7.2 | 8.3 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.677 90<br>1.677 900 | Abbe Number $\nu_d$ | 55.34 | Dispersion $n_F - n_C$       | 0.012 250 |
| Refractive Index $n_e$ | 1.680 820             | Abbe Number $\nu_e$ | 55.08 | Dispersion $n_{F'} - n_{C'}$ | 0.012 361 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.644 14 |
| $n_{1970}$         | 1.970 09  | 1.650 21 |
| $n_{1530}$         | 1.529 58  | 1.656 69 |
| $n_{1129}$         | 1.128 64  | 1.662 42 |
| $n_t$              | 1.013 98  | 1.664 33 |
| $n_s$              | 0.852 11  | 1.667 68 |
| $n_{A'}$           | 0.768 19  | 1.669 98 |
| $n_F$              | 0.706 52  | 1.672 08 |
| $n_C$              | 0.656 27  | 1.674 19 |
| $n_{C'}$           | 0.643 85  | 1.674 78 |
| $n_{He-Ne}$        | 0.632 8   | 1.675 33 |
| $n_D$              | 0.589 29  | 1.677 79 |
| $n_d$              | 0.587 56  | 1.677 90 |
| $n_e$              | 0.546 07  | 1.680 82 |
| $n_F$              | 0.486 13  | 1.686 44 |
| $n_{F'}$           | 0.479 99  | 1.687 14 |
| $n_{He-Cd}$        | 0.441 57  | 1.692 25 |
| $n_g$              | 0.435 835 | 1.693 14 |
| $n_h$              | 0.404 656 | 1.698 72 |
| $n_i$              | 0.365 015 | 1.708 26 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.920 538 95E-01 |
| $A_2$                           | 7.713 777 31E-01 |
| $A_3$                           | 1.182 962 64E+00 |
| $B_1$                           | 1.670 950 63E-02 |
| $B_2$                           | 2.367 501 56E-03 |
| $B_3$                           | 1.059 010 80E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 2    |
| Acid Resistance(Powder) Group RA(P)       | 5    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 53.0 |
| Phosphate Resistance PR                   | 4.2  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 91.0  |
| Rigidity Modulus G (GPa) | 35.4  |
| Poisson's Ratio $\sigma$ | 0.284 |
| Knoop Hardness Hk[Class] | 560 6 |
| Abrasion Aa              | 166   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.009 855 |
| $n_C - n_{A'}$      | 0.004 212 |
| $n_d - n_C$         | 0.003 712 |
| $n_e - n_C$         | 0.006 632 |
| $n_g - n_d$         | 0.015 241 |
| $n_g - n_F$         | 0.006 703 |
| $n_h - n_g$         | 0.005 580 |
| $n_i - n_g$         | 0.015 119 |
| $n_{C'} - n_t$      | 0.010 445 |
| $n_e - n_{C'}$      | 0.006 042 |
| $n_{F'} - n_e$      | 0.006 319 |
| $n_i - n_{F'}$      | 0.021 121 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.804 5 |
| $\theta_{C,A'}$              | 0.343 8 |
| $\theta_{d,C}$               | 0.303 0 |
| $\theta_{e,C}$               | 0.541 4 |
| $\theta_{g,d}$               | 1.244 2 |
| $\theta_{g,F}$               | 0.547 2 |
| $\theta_{h,g}$               | 0.455 5 |
| $\theta_{i,g}$               | 1.234 2 |
| $\theta'_{C,t}$              | 0.845 0 |
| $\theta'_{e,C'}$             | 0.488 8 |
| $\theta'_{F',e}$             | 0.511 2 |
| $\theta'_{i,F'}$             | 1.708 7 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.001 8 |
| $\Delta\theta_{C,A'}$ | 0.000 8  |
| $\Delta\theta_{g,d}$  | -0.005 6 |
| $\Delta\theta_{g,F}$  | -0.004 7 |
| $\Delta\theta_{i,g}$  | -0.027 4 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 360  | $\lambda_5$      | 285 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 337  | $\lambda_{0.05}$ | 279 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.26 | 0.24             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.06             |
| 290                    | 0.15             |
| 300                    | 0.29             |
| 310                    | 0.45             |
| 320                    | 0.61             |
| 330                    | 0.73             |
| 340                    | 0.83             |
| 350                    | 0.89             |
| 360                    | 0.938            |
| 370                    | 0.962            |
| 380                    | 0.976            |
| 390                    | 0.984            |
| 400                    | 0.988            |
| 420                    | 0.992            |
| 440                    | 0.994            |
| 460                    | 0.995            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.997            |
| 1 000                  | 0.996            |
| 1 200                  | 0.996            |
| 1 400                  | 0.991            |
| 1 600                  | 0.991            |
| 1 800                  | 0.981            |
| 2 000                  | 0.963            |
| 2 200                  | 0.901            |
| 2 400                  | 0.73             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 604   |
| Annealing Point AP (°C)                                          | 630   |
| Transformation Temperature Tg (°C)                               | 652   |
| Yield Point At (°C)                                              | 682   |
| Softening Point SP (°C)                                          | 716   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 73    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 86    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.717 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 61                                             |
| -90 ~ -80                               | 62                                             |
| -80 ~ -70                               | 63                                             |
| -70 ~ -60                               | 64                                             |
| -60 ~ -50                               | 65                                             |
| -50 ~ -40                               | 66                                             |
| -40 ~ -30                               | 68                                             |
| -30 ~ -20                               | 69                                             |
| -20 ~ -10                               | 70                                             |
| -10 ~ 0                                 | 71                                             |
| 0 ~ 10                                  | 72                                             |
| 10 ~ 20                                 | 73                                             |
| 20 ~ 30                                 | 74                                             |
| 30 ~ 40                                 | 75                                             |
| 40 ~ 50                                 | 75                                             |
| 50 ~ 60                                 | 76                                             |
| 60 ~ 70                                 | 77                                             |
| 70 ~ 80                                 | 78                                             |
| 80 ~ 90                                 | 79                                             |
| 90 ~ 100                                | 80                                             |
| 100 ~ 110                               | 80                                             |
| 110 ~ 120                               | 81                                             |
| 120 ~ 130                               | 82                                             |
| 130 ~ 140                               | 83                                             |
| 140 ~ 150                               | 83                                             |
| 150 ~ 160                               | 84                                             |
| 160 ~ 170                               | 85                                             |
| 170 ~ 180                               | 85                                             |
| 180 ~ 190                               | 86                                             |
| 190 ~ 200                               | 86                                             |
| 200 ~ 210                               | 87                                             |
| 210 ~ 220                               | 87                                             |
| 220 ~ 230                               | 88                                             |
| 230 ~ 240                               | 88                                             |
| 240 ~ 250                               | 89                                             |
| 250 ~ 260                               | 89                                             |
| 260 ~ 270                               | 90                                             |
| 270 ~ 280                               | 90                                             |
| 280 ~ 290                               | 91                                             |
| 290 ~ 300                               | 91                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.61 |
| Specific Gravity $d$                                     | 4.01 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t    | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | -0.2                                                            | -0.1 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.8 | 0.8 | 1.1 | 1.4 | 2.0 |
| -60 ~ -40                                    | -0.4                                                            | -0.2 | 0.1 | 0.1 | 0.2 | 0.3 | 0.4 | 0.7 | 0.7 | 1.1 | 1.4 | 1.9 |
| -40 ~ -20                                    | -0.4                                                            | -0.3 | 0.1 | 0.2 | 0.2 | 0.3 | 0.5 | 0.7 | 0.7 | 1.0 | 1.4 | 2.0 |
| -20 ~ 0                                      | -0.3                                                            | -0.2 | 0.1 | 0.2 | 0.2 | 0.3 | 0.6 | 0.8 | 0.9 | 1.2 | 1.5 | 2.1 |
| 0 ~ 20                                       | -0.2                                                            | -0.1 | 0.3 | 0.4 | 0.4 | 0.5 | 0.7 | 0.9 | 1.0 | 1.3 | 1.6 | 2.3 |
| 20 ~ 40                                      | -0.1                                                            | 0.0  | 0.3 | 0.5 | 0.5 | 0.7 | 0.8 | 1.1 | 1.1 | 1.5 | 1.8 | 2.4 |
| 40 ~ 60                                      | 0.1                                                             | 0.2  | 0.5 | 0.6 | 0.6 | 0.8 | 0.9 | 1.2 | 1.2 | 1.6 | 1.9 | 2.7 |
| 60 ~ 80                                      | 0.1                                                             | 0.3  | 0.6 | 0.7 | 0.7 | 0.8 | 1.0 | 1.4 | 1.4 | 1.8 | 2.1 | 2.8 |
| 80 ~ 100                                     | 0.3                                                             | 0.4  | 0.7 | 0.8 | 0.8 | 1.0 | 1.1 | 1.4 | 1.5 | 1.8 | 2.3 | 3.0 |
| 100 ~ 120                                    | 0.3                                                             | 0.5  | 0.8 | 0.9 | 0.9 | 1.1 | 1.2 | 1.6 | 1.6 | 2.0 | 2.3 | 3.1 |
| 120 ~ 140                                    | 0.4                                                             | 0.5  | 0.9 | 1.0 | 1.0 | 1.1 | 1.3 | 1.6 | 1.7 | 2.1 | 2.5 | 3.2 |
| 140 ~ 160                                    | 0.4                                                             | 0.6  | 0.9 | 1.0 | 1.0 | 1.2 | 1.4 | 1.8 | 1.8 | 2.2 | 2.6 | 3.3 |
| 160 ~ 180                                    | 0.5                                                             | 0.6  | 1.0 | 1.1 | 1.1 | 1.3 | 1.4 | 1.8 | 1.8 | 2.2 | 2.6 | 3.3 |

## S-LAL12Q

Code(d) 678553

Code(e) 681551

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.677 90<br>1.677 900 | Abbe Number $\nu_d$ | 55.35 | Dispersion $n_F - n_C$       | 0.012 248 |
| Refractive Index $n_e$ | 1.680 821             | Abbe Number $\nu_e$ | 55.12 | Dispersion $n_{F'} - n_{C'}$ | 0.012 351 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.641 08 |
| $n_{1970}$         | 1.970 09  | 1.648 21 |
| $n_{1530}$         | 1.529 58  | 1.655 66 |
| $n_{1129}$         | 1.128 64  | 1.662 00 |
| $n_t$              | 1.013 98  | 1.664 04 |
| $n_s$              | 0.852 11  | 1.667 54 |
| $n_{A'}$           | 0.768 19  | 1.669 90 |
| $n_F$              | 0.706 52  | 1.672 04 |
| $n_C$              | 0.656 27  | 1.674 17 |
| $n_{C'}$           | 0.643 85  | 1.674 76 |
| $n_{He-Ne}$        | 0.632 8   | 1.675 32 |
| $n_D$              | 0.589 29  | 1.677 79 |
| $n_d$              | 0.587 56  | 1.677 90 |
| $n_e$              | 0.546 07  | 1.680 82 |
| $n_F$              | 0.486 13  | 1.686 42 |
| $n_{F'}$           | 0.479 99  | 1.687 12 |
| $n_{He-Cd}$        | 0.441 57  | 1.692 19 |
| $n_g$              | 0.435 835 | 1.693 07 |
| $n_h$              | 0.404 656 | 1.698 60 |
| $n_i$              | 0.365 015 | 1.708 03 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.098 870 25E+00 |
| $A_2$                           | 6.655 004 82E-01 |
| $A_3$                           | 1.071 836 58E+00 |
| $B_1$                           | 5.381 037 54E-03 |
| $B_2$                           | 1.867 177 09E-02 |
| $B_3$                           | 8.308 165 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 51.0 |
| Phosphate Resistance PR                   | 3.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 106.8 |
| Rigidity Modulus G (GPa) | 41.4  |
| Poisson's Ratio $\sigma$ | 0.289 |
| Knoop Hardness Hk[Class] | 700 7 |
| Abrasion Aa              | 62    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 130 |
| $n_C - n_{A'}$      | 0.004 273 |
| $n_d - n_C$         | 0.003 729 |
| $n_e - n_C$         | 0.006 650 |
| $n_g - n_d$         | 0.015 174 |
| $n_g - n_F$         | 0.006 655 |
| $n_h - n_g$         | 0.005 527 |
| $n_i - n_g$         | 0.014 954 |
| $n_{C'} - n_t$      | 0.010 724 |
| $n_e - n_{C'}$      | 0.006 056 |
| $n_{F'} - n_e$      | 0.006 295 |
| $n_i - n_{F'}$      | 0.020 912 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.827 1 |
| $\theta_{C,A'}$              | 0.348 9 |
| $\theta_{d,C}$               | 0.304 5 |
| $\theta_{e,C}$               | 0.542 9 |
| $\theta_{g,d}$               | 1.238 9 |
| $\theta_{g,F}$               | 0.543 4 |
| $\theta_{h,g}$               | 0.451 3 |
| $\theta_{i,g}$               | 1.220 9 |
| $\theta'_{C,t}$              | 0.868 3 |
| $\theta'_{e,C'}$             | 0.490 3 |
| $\theta'_{F,e}$              | 0.509 7 |
| $\theta'_{i,F'}$             | 1.693 1 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.020 7  |
| $\Delta\theta_{C,A'}$ | 0.005 9  |
| $\Delta\theta_{g,d}$  | -0.010 9 |
| $\Delta\theta_{g,F}$  | -0.008 5 |
| $\Delta\theta_{i,g}$  | -0.040 6 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 380  | $\lambda_5$      | 310 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 363  | $\lambda_{0.05}$ | 308 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.53 | 0.50             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    | 0.01             |
| 310                    | 0.06             |
| 320                    | 0.15             |
| 330                    | 0.30             |
| 340                    | 0.48             |
| 350                    | 0.64             |
| 360                    | 0.77             |
| 370                    | 0.86             |
| 380                    | 0.917            |
| 390                    | 0.950            |
| 400                    | 0.969            |
| 420                    | 0.987            |
| 440                    | 0.993            |
| 460                    | 0.996            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.996            |
| 1 000                  | 0.996            |
| 1 200                  | 0.996            |
| 1 400                  | 0.981            |
| 1 600                  | 0.988            |
| 1 800                  | 0.975            |
| 2 000                  | 0.944            |
| 2 200                  | 0.82             |
| 2 400                  | 0.59             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 637   |
| Annealing Point AP (°C)                                          | 670   |
| Transformation Temperature Tg (°C)                               | 690   |
| Yield Point At (°C)                                              | 718   |
| Softening Point SP (°C)                                          | 750   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 49    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 61    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.914 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 37                                             |
| -90 ~ -80                               | 38                                             |
| -80 ~ -70                               | 39                                             |
| -70 ~ -60                               | 41                                             |
| -60 ~ -50                               | 42                                             |
| -50 ~ -40                               | 43                                             |
| -40 ~ -30                               | 44                                             |
| -30 ~ -20                               | 45                                             |
| -20 ~ -10                               | 46                                             |
| -10 ~ 0                                 | 47                                             |
| 0 ~ 10                                  | 48                                             |
| 10 ~ 20                                 | 49                                             |
| 20 ~ 30                                 | 50                                             |
| 30 ~ 40                                 | 50                                             |
| 40 ~ 50                                 | 51                                             |
| 50 ~ 60                                 | 52                                             |
| 60 ~ 70                                 | 53                                             |
| 70 ~ 80                                 | 54                                             |
| 80 ~ 90                                 | 55                                             |
| 90 ~ 100                                | 55                                             |
| 100 ~ 110                               | 56                                             |
| 110 ~ 120                               | 57                                             |
| 120 ~ 130                               | 57                                             |
| 130 ~ 140                               | 58                                             |
| 140 ~ 150                               | 59                                             |
| 150 ~ 160                               | 59                                             |
| 160 ~ 170                               | 60                                             |
| 170 ~ 180                               | 60                                             |
| 180 ~ 190                               | 61                                             |
| 190 ~ 200                               | 62                                             |
| 200 ~ 210                               | 62                                             |
| 210 ~ 220                               | 63                                             |
| 220 ~ 230                               | 63                                             |
| 230 ~ 240                               | 63                                             |
| 240 ~ 250                               | 64                                             |
| 250 ~ 260                               | 64                                             |
| 260 ~ 270                               | 65                                             |
| 270 ~ 280                               | 65                                             |
| 280 ~ 290                               | 65                                             |
| 290 ~ 300                               | 66                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.97 |
| Specific Gravity $d$                                      | 3.59 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 4.5                                                             | 4.6 | 4.8 | 4.9 | 4.9 | 5.2 | 5.3 | 5.5 | 5.6 | 5.9 | 6.2 | 6.8 |
| -60 ~ -40                                    | 4.3                                                             | 4.5 | 4.8 | 4.8 | 4.9 | 5.0 | 5.1 | 5.4 | 5.4 | 5.8 | 6.1 | 6.7 |
| -40 ~ -20                                    | 4.3                                                             | 4.4 | 4.8 | 4.9 | 4.9 | 5.0 | 5.1 | 5.4 | 5.5 | 5.8 | 6.2 | 6.8 |
| -20 ~ 0                                      | 4.3                                                             | 4.5 | 4.7 | 4.8 | 4.9 | 5.0 | 5.2 | 5.5 | 5.6 | 5.9 | 6.2 | 6.8 |
| 0 ~ 20                                       | 4.4                                                             | 4.5 | 4.9 | 5.0 | 5.0 | 5.2 | 5.3 | 5.6 | 5.7 | 6.0 | 6.3 | 7.1 |
| 20 ~ 40                                      | 4.5                                                             | 4.6 | 4.9 | 5.1 | 5.2 | 5.3 | 5.5 | 5.8 | 5.8 | 6.2 | 6.5 | 7.2 |
| 40 ~ 60                                      | 4.7                                                             | 4.8 | 5.2 | 5.3 | 5.3 | 5.4 | 5.6 | 5.9 | 6.0 | 6.3 | 6.7 | 7.4 |
| 60 ~ 80                                      | 4.7                                                             | 4.9 | 5.2 | 5.3 | 5.4 | 5.5 | 5.8 | 6.1 | 6.2 | 6.5 | 6.9 | 7.6 |
| 80 ~ 100                                     | 4.9                                                             | 5.1 | 5.4 | 5.5 | 5.5 | 5.7 | 5.9 | 6.2 | 6.3 | 6.7 | 7.1 | 7.8 |
| 100 ~ 120                                    | 5.0                                                             | 5.2 | 5.5 | 5.7 | 5.7 | 5.9 | 6.0 | 6.4 | 6.4 | 6.8 | 7.2 | 8.0 |
| 120 ~ 140                                    | 5.1                                                             | 5.3 | 5.7 | 5.8 | 5.8 | 6.0 | 6.2 | 6.5 | 6.6 | 7.0 | 7.5 | 8.3 |
| 140 ~ 160                                    | 5.2                                                             | 5.4 | 5.8 | 5.9 | 5.9 | 6.1 | 6.4 | 6.7 | 6.8 | 7.2 | 7.6 | 8.4 |
| 160 ~ 180                                    | 5.4                                                             | 5.6 | 5.9 | 6.0 | 6.1 | 6.3 | 6.5 | 6.8 | 6.9 | 7.3 | 7.7 | 8.5 |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.696 80<br>1.696 797 | Abbe Number $\nu_d$ | 55.53 | Dispersion $n_F - n_C$       | 0.012 548 |
| Refractive Index $n_e$ | 1.699 788             | Abbe Number $\nu_e$ | 55.31 | Dispersion $n_{F'} - n_{C'}$ | 0.012 653 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.658 20 |
| $n_{1970}$         | 1.970 09  | 1.665 78 |
| $n_{1530}$         | 1.529 58  | 1.673 69 |
| $n_{1129}$         | 1.128 64  | 1.680 39 |
| $n_t$              | 1.013 98  | 1.682 52 |
| $n_s$              | 0.852 11  | 1.686 15 |
| $n_{A'}$           | 0.768 19  | 1.688 58 |
| $n_F$              | 0.706 52  | 1.690 79 |
| $n_C$              | 0.656 27  | 1.692 97 |
| $n_{C'}$           | 0.643 85  | 1.693 58 |
| $n_{He-Ne}$        | 0.632 8   | 1.694 15 |
| $n_D$              | 0.589 29  | 1.696 69 |
| $n_d$              | 0.587 56  | 1.696 80 |
| $n_e$              | 0.546 07  | 1.699 79 |
| $n_F$              | 0.486 13  | 1.705 52 |
| $n_{F'}$           | 0.479 99  | 1.706 24 |
| $n_{He-Cd}$        | 0.441 57  | 1.711 44 |
| $n_g$              | 0.435 835 | 1.712 34 |
| $n_h$              | 0.404 656 | 1.718 00 |
| $n_i$              | 0.365 015 | 1.727 67 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 1.237 209 70E+00  |
| $A_2$                           | 5.897 226 23E-01  |
| $A_3$                           | 1.319 218 80E+00  |
| $B_1$                           | 1.535 513 20E-02  |
| $B_2$                           | -3.078 962 50E-04 |
| $B_3$                           | 9.372 029 47E+01  |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 1~2  |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 3.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 111.8 |
| Rigidity Modulus G (GPa) | 43.5  |
| Poisson's Ratio $\sigma$ | 0.284 |
| Knoop Hardness Hk[Class] | 660 7 |
| Abrasion Aa              | 83    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 452 |
| $n_C - n_{A'}$      | 0.004 389 |
| $n_d - n_C$         | 0.003 823 |
| $n_e - n_C$         | 0.006 814 |
| $n_g - n_d$         | 0.015 543 |
| $n_g - n_F$         | 0.006 818 |
| $n_h - n_g$         | 0.005 665 |
| $n_i - n_g$         | 0.015 333 |
| $n_{C'} - n_t$      | 0.011 061 |
| $n_e - n_{C'}$      | 0.006 205 |
| $n_{F'} - n_e$      | 0.006 448 |
| $n_i - n_{F'}$      | 0.021 437 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.833 0 |
| $\theta_{C,A'}$              | 0.349 8 |
| $\theta_{d,C}$               | 0.304 7 |
| $\theta_{e,C}$               | 0.543 0 |
| $\theta_{g,d}$               | 1.238 7 |
| $\theta_{g,F}$               | 0.543 4 |
| $\theta_{h,g}$               | 0.451 5 |
| $\theta_{i,g}$               | 1.221 9 |
| $\theta'_{C,t}$              | 0.874 2 |
| $\theta'_{e,C'}$             | 0.490 4 |
| $\theta'_{F',e}$             | 0.509 6 |
| $\theta'_{i,F'}$             | 1.694 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.025 8  |
| $\Delta\theta_{C,A'}$ | 0.006 6  |
| $\Delta\theta_{g,d}$  | -0.010 7 |
| $\Delta\theta_{g,F}$  | -0.008 2 |
| $\Delta\theta_{i,g}$  | -0.038 1 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 365  | $\lambda_5$      | 285 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 349  | $\lambda_{0.05}$ | 285 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.32 | 0.29             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.03             |
| 290                    | 0.07             |
| 300                    | 0.15             |
| 310                    | 0.27             |
| 320                    | 0.41             |
| 330                    | 0.56             |
| 340                    | 0.70             |
| 350                    | 0.81             |
| 360                    | 0.88             |
| 370                    | 0.931            |
| 380                    | 0.959            |
| 390                    | 0.974            |
| 400                    | 0.982            |
| 420                    | 0.990            |
| 440                    | 0.993            |
| 460                    | 0.995            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.991            |
| 1 600                  | 0.992            |
| 1 800                  | 0.982            |
| 2 000                  | 0.954            |
| 2 200                  | 0.86             |
| 2 400                  | 0.59             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 643   |
| Yield Point At (°C)                                              | 677   |
| Softening Point SP (°C)                                          | 700   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 58    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 70    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.908 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 44                                             |
| -90 ~ -80                               | 46                                             |
| -80 ~ -70                               | 47                                             |
| -70 ~ -60                               | 49                                             |
| -60 ~ -50                               | 50                                             |
| -50 ~ -40                               | 51                                             |
| -40 ~ -30                               | 52                                             |
| -30 ~ -20                               | 54                                             |
| -20 ~ -10                               | 55                                             |
| -10 ~ 0                                 | 56                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 60                                             |
| 40 ~ 50                                 | 61                                             |
| 50 ~ 60                                 | 62                                             |
| 60 ~ 70                                 | 63                                             |
| 70 ~ 80                                 | 63                                             |
| 80 ~ 90                                 | 64                                             |
| 90 ~ 100                                | 65                                             |
| 100 ~ 110                               | 66                                             |
| 110 ~ 120                               | 66                                             |
| 120 ~ 130                               | 67                                             |
| 130 ~ 140                               | 68                                             |
| 140 ~ 150                               | 68                                             |
| 150 ~ 160                               | 69                                             |
| 160 ~ 170                               | 69                                             |
| 170 ~ 180                               | 69                                             |
| 180 ~ 190                               | 70                                             |
| 190 ~ 200                               | 70                                             |
| 200 ~ 210                               | 71                                             |
| 210 ~ 220                               | 71                                             |
| 220 ~ 230                               | 71                                             |
| 230 ~ 240                               | 71                                             |
| 240 ~ 250                               | 71                                             |
| 250 ~ 260                               | 72                                             |
| 260 ~ 270                               | 72                                             |
| 270 ~ 280                               | 72                                             |
| 280 ~ 290                               | 72                                             |
| 290 ~ 300                               | 72                                             |

| Other Properties                                        |      |
|---------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>105</sup> Pa) | 1.86 |
| Specific Gravity $d$                                    | 3.70 |
| Remarks                                                 |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.6                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.2 | 3.3 | 3.5 | 3.6 | 3.9 | 4.2 | 4.8 |
| -60 ~ -40                                    | 2.5                                                             | 2.7 | 2.9 | 3.0 | 3.0 | 3.1 | 3.2 | 3.5 | 3.6 | 3.8 | 4.1 | 4.7 |
| -40 ~ -20                                    | 2.5                                                             | 2.7 | 2.9 | 3.0 | 3.0 | 3.1 | 3.3 | 3.5 | 3.6 | 3.9 | 4.2 | 4.8 |
| -20 ~ 0                                      | 2.5                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.3 | 3.4 | 3.7 | 3.7 | 4.0 | 4.3 | 5.0 |
| 0 ~ 20                                       | 2.7                                                             | 2.8 | 3.1 | 3.2 | 3.2 | 3.4 | 3.5 | 3.8 | 3.8 | 4.2 | 4.5 | 5.2 |
| 20 ~ 40                                      | 2.7                                                             | 2.9 | 3.3 | 3.3 | 3.4 | 3.5 | 3.7 | 4.0 | 4.0 | 4.3 | 4.7 | 5.3 |
| 40 ~ 60                                      | 2.9                                                             | 3.1 | 3.4 | 3.5 | 3.5 | 3.6 | 3.8 | 4.1 | 4.1 | 4.5 | 4.9 | 5.7 |
| 60 ~ 80                                      | 3.0                                                             | 3.1 | 3.6 | 3.7 | 3.6 | 3.9 | 4.0 | 4.3 | 4.4 | 4.8 | 5.2 | 5.9 |
| 80 ~ 100                                     | 3.1                                                             | 3.3 | 3.6 | 3.7 | 3.7 | 3.9 | 4.1 | 4.4 | 4.5 | 5.0 | 5.4 | 6.1 |
| 100 ~ 120                                    | 3.2                                                             | 3.4 | 3.7 | 3.9 | 3.9 | 4.1 | 4.2 | 4.6 | 4.6 | 5.1 | 5.6 | 6.3 |
| 120 ~ 140                                    | 3.3                                                             | 3.5 | 3.8 | 4.0 | 4.0 | 4.2 | 4.4 | 4.7 | 4.8 | 5.3 | 5.7 | 6.5 |
| 140 ~ 160                                    | 3.3                                                             | 3.5 | 4.0 | 4.1 | 4.2 | 4.3 | 4.5 | 4.9 | 5.0 | 5.4 | 5.9 | 6.7 |
| 160 ~ 180                                    | 3.4                                                             | 3.6 | 4.0 | 4.2 | 4.2 | 4.4 | 4.6 | 5.0 | 5.0 | 5.5 | 6.0 | 6.8 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.729 16<br>1.729 157 | Abbe Number $\nu_d$ | 54.68 | Dispersion $n_F - n_C$       | 0.013 335 |
| Refractive Index $n_e$ | 1.732 336             | Abbe Number $\nu_e$ | 54.45 | Dispersion $n_{F'} - n_{C'}$ | 0.013 449 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.689 36 |
| $n_{1970}$         | 1.970 09  | 1.697 01 |
| $n_{1530}$         | 1.529 58  | 1.705 04 |
| $n_{1129}$         | 1.128 64  | 1.711 90 |
| $n_t$              | 1.013 98  | 1.714 11 |
| $n_s$              | 0.852 11  | 1.717 90 |
| $n_{A'}$           | 0.768 19  | 1.720 46 |
| $n_F$              | 0.706 52  | 1.722 79 |
| $n_C$              | 0.656 27  | 1.725 10 |
| $n_{C'}$           | 0.643 85  | 1.725 75 |
| $n_{He-Ne}$        | 0.632 8   | 1.726 35 |
| $n_D$              | 0.589 29  | 1.729 04 |
| $n_d$              | 0.587 56  | 1.729 16 |
| $n_e$              | 0.546 07  | 1.732 34 |
| $n_F$              | 0.486 13  | 1.738 44 |
| $n_{F'}$           | 0.479 99  | 1.739 20 |
| $n_{He-Cd}$        | 0.441 57  | 1.744 73 |
| $n_g$              | 0.435 835 | 1.745 70 |
| $n_h$              | 0.404 656 | 1.751 73 |
| $n_i$              | 0.365 015 | 1.762 03 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 1.502 763 18E+00  |
| $A_2$                           | 4.302 244 97E-01  |
| $A_3$                           | 1.347 260 60E+00  |
| $B_1$                           | 1.454 623 56E-02  |
| $B_2$                           | -3.327 841 53E-03 |
| $B_3$                           | 9.335 083 42E+01  |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 120.4 |
| Rigidity Modulus G (GPa) | 46.7  |
| Poisson's Ratio $\sigma$ | 0.289 |
| Knoop Hardness Hk[Class] | 720 7 |
| Abrasion Aa              | 69    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 994 |
| $n_C - n_{A'}$      | 0.004 641 |
| $n_d - n_C$         | 0.004 056 |
| $n_e - n_C$         | 0.007 235 |
| $n_g - n_d$         | 0.016 539 |
| $n_g - n_F$         | 0.007 260 |
| $n_h - n_g$         | 0.006 035 |
| $n_i - n_g$         | 0.016 335 |
| $n_{C'} - n_t$      | 0.011 640 |
| $n_e - n_{C'}$      | 0.006 589 |
| $n_{F'} - n_e$      | 0.006 860 |
| $n_i - n_{F'}$      | 0.022 835 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.824 4 |
| $\theta_{C,A'}$              | 0.348 0 |
| $\theta_{d,C}$               | 0.304 2 |
| $\theta_{e,C}$               | 0.542 6 |
| $\theta_{g,d}$               | 1.240 3 |
| $\theta_{g,F}$               | 0.544 4 |
| $\theta_{h,g}$               | 0.452 6 |
| $\theta_{i,g}$               | 1.225 0 |
| $\theta'_{C,t}$              | 0.865 5 |
| $\theta'_{e,C'}$             | 0.489 9 |
| $\theta'_{F',e}$             | 0.510 1 |
| $\theta'_{i,F'}$             | 1.697 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.021 2  |
| $\Delta\theta_{C,A'}$ | 0.005 8  |
| $\Delta\theta_{g,d}$  | -0.010 9 |
| $\Delta\theta_{g,F}$  | -0.008 6 |
| $\Delta\theta_{i,g}$  | -0.042 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 365  | $\lambda_5$      | 280 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 343  | $\lambda_{0.05}$ | 281 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.30 | 0.31             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.04             |
| 290                    | 0.21             |
| 300                    | 0.30             |
| 310                    | 0.32             |
| 320                    | 0.55             |
| 330                    | 0.68             |
| 340                    | 0.78             |
| 350                    | 0.86             |
| 360                    | 0.912            |
| 370                    | 0.946            |
| 380                    | 0.967            |
| 390                    | 0.978            |
| 400                    | 0.984            |
| 420                    | 0.991            |
| 440                    | 0.994            |
| 460                    | 0.996            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.996            |
| 1 400                  | 0.991            |
| 1 600                  | 0.991            |
| 1 800                  | 0.982            |
| 2 000                  | 0.956            |
| 2 200                  | 0.87             |
| 2 400                  | 0.60             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 632   |
| Annealing Point AP (°C)                                          | 655   |
| Transformation Temperature Tg (°C)                               | 679   |
| Yield Point At (°C)                                              | 703   |
| Softening Point SP (°C)                                          | 731   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 58    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 72    |
| Thermal Conductivity $\lambda$ (W/(mK))                          | 0.871 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 44                                             |
| -90 ~ -80                               | 46                                             |
| -80 ~ -70                               | 47                                             |
| -70 ~ -60                               | 48                                             |
| -60 ~ -50                               | 50                                             |
| -50 ~ -40                               | 51                                             |
| -40 ~ -30                               | 52                                             |
| -30 ~ -20                               | 53                                             |
| -20 ~ -10                               | 54                                             |
| -10 ~ 0                                 | 56                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 60                                             |
| 40 ~ 50                                 | 61                                             |
| 50 ~ 60                                 | 62                                             |
| 60 ~ 70                                 | 63                                             |
| 70 ~ 80                                 | 64                                             |
| 80 ~ 90                                 | 65                                             |
| 90 ~ 100                                | 65                                             |
| 100 ~ 110                               | 66                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 69                                             |
| 140 ~ 150                               | 69                                             |
| 150 ~ 160                               | 70                                             |
| 160 ~ 170                               | 71                                             |
| 170 ~ 180                               | 71                                             |
| 180 ~ 190                               | 72                                             |
| 190 ~ 200                               | 72                                             |
| 200 ~ 210                               | 73                                             |
| 210 ~ 220                               | 74                                             |
| 220 ~ 230                               | 74                                             |
| 230 ~ 240                               | 74                                             |
| 240 ~ 250                               | 75                                             |
| 250 ~ 260                               | 75                                             |
| 260 ~ 270                               | 76                                             |
| 270 ~ 280                               | 76                                             |
| 280 ~ 290                               | 76                                             |
| 290 ~ 300                               | 77                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.58 |
| Specific Gravity $d$                                     | 4.18 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.5                                                             | 2.6 | 2.9 | 2.9 | 3.0 | 3.2 | 3.3 | 3.6 | 3.6 | 3.9 | 4.3 | 4.9 |
| -60 ~ -40                                    | 2.4                                                             | 2.5 | 2.8 | 2.9 | 2.9 | 3.1 | 3.2 | 3.5 | 3.5 | 3.9 | 4.3 | 4.9 |
| -40 ~ -20                                    | 2.4                                                             | 2.5 | 2.8 | 2.9 | 2.9 | 3.0 | 3.3 | 3.5 | 3.6 | 3.9 | 4.2 | 5.0 |
| -20 ~ 0                                      | 2.5                                                             | 2.6 | 2.9 | 3.0 | 3.0 | 3.1 | 3.3 | 3.6 | 3.6 | 4.1 | 4.4 | 5.1 |
| 0 ~ 20                                       | 2.5                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.2 | 3.4 | 3.7 | 3.7 | 4.2 | 4.5 | 5.2 |
| 20 ~ 40                                      | 2.7                                                             | 2.8 | 3.1 | 3.2 | 3.2 | 3.4 | 3.5 | 3.9 | 3.9 | 4.2 | 4.7 | 5.4 |
| 40 ~ 60                                      | 2.8                                                             | 2.9 | 3.2 | 3.3 | 3.4 | 3.5 | 3.7 | 4.0 | 4.0 | 4.5 | 4.9 | 5.6 |
| 60 ~ 80                                      | 2.9                                                             | 3.1 | 3.4 | 3.5 | 3.6 | 3.7 | 3.9 | 4.2 | 4.2 | 4.6 | 5.0 | 5.7 |
| 80 ~ 100                                     | 3.0                                                             | 3.2 | 3.5 | 3.6 | 3.7 | 3.9 | 4.1 | 4.4 | 4.4 | 4.8 | 5.2 | 6.0 |
| 100 ~ 120                                    | 3.1                                                             | 3.3 | 3.6 | 3.7 | 3.7 | 3.9 | 4.2 | 4.5 | 4.5 | 5.0 | 5.4 | 6.1 |
| 120 ~ 140                                    | 3.2                                                             | 3.4 | 3.8 | 3.8 | 3.9 | 4.1 | 4.2 | 4.6 | 4.7 | 5.1 | 5.5 | 6.3 |
| 140 ~ 160                                    | 3.4                                                             | 3.6 | 3.9 | 4.0 | 4.0 | 4.2 | 4.4 | 4.7 | 4.8 | 5.2 | 5.6 | 6.4 |
| 160 ~ 180                                    | 3.4                                                             | 3.6 | 3.9 | 4.0 | 4.1 | 4.3 | 4.4 | 4.8 | 4.8 | 5.3 | 5.7 | 6.5 |

## S-LAL18N

Code(d) 729546

Code(e) 732544

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.729 16<br>1.729 157 | Abbe Number $\nu_d$ | 54.59 | Dispersion $n_F - n_C$       | 0.013 356 |
| Refractive Index $n_e$ | 1.732 341             | Abbe Number $\nu_e$ | 54.37 | Dispersion $n_{F'} - n_{C'}$ | 0.013 470 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.689 32 |
| $n_{1970}$         | 1.970 09  | 1.697 00 |
| $n_{1530}$         | 1.529 58  | 1.705 03 |
| $n_{1129}$         | 1.128 64  | 1.711 87 |
| $n_t$              | 1.013 98  | 1.714 08 |
| $n_s$              | 0.852 11  | 1.717 88 |
| $n_{A'}$           | 0.768 19  | 1.720 44 |
| $n_F$              | 0.706 52  | 1.722 78 |
| $n_C$              | 0.656 27  | 1.725 09 |
| $n_{C'}$           | 0.643 85  | 1.725 74 |
| $n_{He-Ne}$        | 0.632 8   | 1.726 34 |
| $n_D$              | 0.589 29  | 1.729 04 |
| $n_d$              | 0.587 56  | 1.729 16 |
| $n_e$              | 0.546 07  | 1.732 34 |
| $n_F$              | 0.486 13  | 1.738 45 |
| $n_{F'}$           | 0.479 99  | 1.739 21 |
| $n_{He-Cd}$        | 0.441 57  | 1.744 75 |
| $n_g$              | 0.435 835 | 1.745 72 |
| $n_h$              | 0.404 656 | 1.751 76 |
| $n_i$              | 0.365 015 | 1.762 08 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.431 317 27E+00 |
| $A_2$                           | 5.012 968 55E-01 |
| $A_3$                           | 1.154 648 35E+00 |
| $B_1$                           | 6.827 832 22E-03 |
| $B_2$                           | 2.158 403 29E-02 |
| $B_3$                           | 8.098 327 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 120.4 |
| Rigidity Modulus G (GPa) | 46.7  |
| Poisson's Ratio $\sigma$ | 0.289 |
| Knoop Hardness Hk[Class] | 720   |
| Abrasion Aa              | 69    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 009 |
| $n_C - n_{A'}$      | 0.004 650 |
| $n_d - n_C$         | 0.004 064 |
| $n_e - n_C$         | 0.007 248 |
| $n_g - n_d$         | 0.016 561 |
| $n_g - n_F$         | 0.007 269 |
| $n_h - n_g$         | 0.006 042 |
| $n_i - n_g$         | 0.016 363 |
| $n_{C'} - n_t$      | 0.011 656 |
| $n_e - n_{C'}$      | 0.006 601 |
| $n_{F'} - n_e$      | 0.006 869 |
| $n_i - n_{F'}$      | 0.022 871 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.824 3 |
| $\theta_{C,A'}$              | 0.348 2 |
| $\theta_{d,C}$               | 0.304 3 |
| $\theta_{e,C}$               | 0.542 7 |
| $\theta_{g,d}$               | 1.240 0 |
| $\theta_{g,F}$               | 0.544 2 |
| $\theta_{h,g}$               | 0.452 4 |
| $\theta_{i,g}$               | 1.225 1 |
| $\theta'_{C,t}$              | 0.865 3 |
| $\theta'_{e,C'}$             | 0.490 1 |
| $\theta'_{F',e}$             | 0.509 9 |
| $\theta'_{i,F'}$             | 1.697 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.021 5  |
| $\Delta\theta_{C,A'}$ | 0.006 2  |
| $\Delta\theta_{g,d}$  | -0.011 3 |
| $\Delta\theta_{g,F}$  | -0.008 9 |
| $\Delta\theta_{i,g}$  | -0.042 8 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 365  | $\lambda_5$      | 280 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 343  | $\lambda_{0.05}$ | 281 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.30 | 0.31             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.04             |
| 290                    | 0.21             |
| 300                    | 0.30             |
| 310                    | 0.32             |
| 320                    | 0.55             |
| 330                    | 0.68             |
| 340                    | 0.78             |
| 350                    | 0.86             |
| 360                    | 0.912            |
| 370                    | 0.946            |
| 380                    | 0.967            |
| 390                    | 0.978            |
| 400                    | 0.984            |
| 420                    | 0.991            |
| 440                    | 0.994            |
| 460                    | 0.996            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.996            |
| 1 400                  | 0.991            |
| 1 600                  | 0.991            |
| 1 800                  | 0.982            |
| 2 000                  | 0.956            |
| 2 200                  | 0.87             |
| 2 400                  | 0.60             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 632   |
| Annealing Point AP (°C)                                          | 655   |
| Transformation Temperature Tg (°C)                               | 679   |
| Yield Point At (°C)                                              | 703   |
| Softening Point SP (°C)                                          | 731   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 58    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 72    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.871 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 44                                             |
| -90 ~ -80                               | 46                                             |
| -80 ~ -70                               | 47                                             |
| -70 ~ -60                               | 48                                             |
| -60 ~ -50                               | 50                                             |
| -50 ~ -40                               | 51                                             |
| -40 ~ -30                               | 52                                             |
| -30 ~ -20                               | 53                                             |
| -20 ~ -10                               | 54                                             |
| -10 ~ 0                                 | 56                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 60                                             |
| 40 ~ 50                                 | 61                                             |
| 50 ~ 60                                 | 62                                             |
| 60 ~ 70                                 | 63                                             |
| 70 ~ 80                                 | 64                                             |
| 80 ~ 90                                 | 65                                             |
| 90 ~ 100                                | 65                                             |
| 100 ~ 110                               | 66                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 69                                             |
| 140 ~ 150                               | 69                                             |
| 150 ~ 160                               | 70                                             |
| 160 ~ 170                               | 71                                             |
| 170 ~ 180                               | 71                                             |
| 180 ~ 190                               | 72                                             |
| 190 ~ 200                               | 72                                             |
| 200 ~ 210                               | 73                                             |
| 210 ~ 220                               | 74                                             |
| 220 ~ 230                               | 74                                             |
| 230 ~ 240                               | 74                                             |
| 240 ~ 250                               | 75                                             |
| 250 ~ 260                               | 75                                             |
| 260 ~ 270                               | 76                                             |
| 270 ~ 280                               | 76                                             |
| 280 ~ 290                               | 76                                             |
| 290 ~ 300                               | 77                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.58 |
| Specific Gravity $d$                                     | 4.18 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.5                                                             | 2.6 | 2.9 | 2.9 | 3.0 | 3.2 | 3.3 | 3.6 | 3.6 | 3.9 | 4.3 | 4.9 |
| -60 ~ -40                                    | 2.4                                                             | 2.5 | 2.8 | 2.9 | 2.9 | 3.1 | 3.2 | 3.5 | 3.5 | 3.9 | 4.3 | 4.9 |
| -40 ~ -20                                    | 2.4                                                             | 2.5 | 2.8 | 2.9 | 2.9 | 3.0 | 3.3 | 3.5 | 3.6 | 3.9 | 4.2 | 5.0 |
| -20 ~ 0                                      | 2.5                                                             | 2.6 | 2.9 | 3.0 | 3.0 | 3.1 | 3.3 | 3.6 | 3.6 | 4.1 | 4.4 | 5.1 |
| 0 ~ 20                                       | 2.5                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.2 | 3.4 | 3.7 | 3.7 | 4.2 | 4.5 | 5.2 |
| 20 ~ 40                                      | 2.7                                                             | 2.8 | 3.1 | 3.2 | 3.2 | 3.4 | 3.5 | 3.9 | 3.9 | 4.2 | 4.7 | 5.4 |
| 40 ~ 60                                      | 2.8                                                             | 2.9 | 3.2 | 3.3 | 3.4 | 3.5 | 3.7 | 4.0 | 4.0 | 4.5 | 4.9 | 5.6 |
| 60 ~ 80                                      | 2.9                                                             | 3.1 | 3.4 | 3.5 | 3.6 | 3.7 | 3.9 | 4.2 | 4.2 | 4.6 | 5.0 | 5.7 |
| 80 ~ 100                                     | 3.0                                                             | 3.2 | 3.5 | 3.6 | 3.7 | 3.9 | 4.1 | 4.4 | 4.4 | 4.8 | 5.2 | 6.0 |
| 100 ~ 120                                    | 3.1                                                             | 3.3 | 3.6 | 3.7 | 3.7 | 3.9 | 4.2 | 4.5 | 4.5 | 5.0 | 5.4 | 6.1 |
| 120 ~ 140                                    | 3.2                                                             | 3.4 | 3.8 | 3.8 | 3.9 | 4.1 | 4.2 | 4.6 | 4.7 | 5.1 | 5.5 | 6.3 |
| 140 ~ 160                                    | 3.4                                                             | 3.6 | 3.9 | 4.0 | 4.0 | 4.2 | 4.4 | 4.7 | 4.8 | 5.2 | 5.6 | 6.4 |
| 160 ~ 180                                    | 3.4                                                             | 3.6 | 3.9 | 4.0 | 4.1 | 4.3 | 4.4 | 4.8 | 4.8 | 5.3 | 5.7 | 6.5 |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.729 16<br>1.729 160 | Abbe Number $\nu_d$ | 54.09 | Dispersion $n_F - n_C$       | 0.013 480 |
| Refractive Index $n_e$ | 1.732 373             | Abbe Number $\nu_e$ | 53.87 | Dispersion $n_{F'} - n_{C'}$ | 0.013 596 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.689 12 |
| $n_{1970}$         | 1.970 09  | 1.696 82 |
| $n_{1530}$         | 1.529 58  | 1.704 87 |
| $n_{1129}$         | 1.128 64  | 1.711 75 |
| $n_t$              | 1.013 98  | 1.713 97 |
| $n_s$              | 0.852 11  | 1.717 79 |
| $n_{A'}$           | 0.768 19  | 1.720 38 |
| $n_F$              | 0.706 52  | 1.722 73 |
| $n_C$              | 0.656 27  | 1.725 06 |
| $n_{C'}$           | 0.643 85  | 1.725 71 |
| $n_{He-Ne}$        | 0.632 8   | 1.726 32 |
| $n_D$              | 0.589 29  | 1.729 04 |
| $n_d$              | 0.587 56  | 1.729 16 |
| $n_e$              | 0.546 07  | 1.732 37 |
| $n_F$              | 0.486 13  | 1.738 54 |
| $n_{F'}$           | 0.479 99  | 1.739 31 |
| $n_{He-Cd}$        | 0.441 57  | 1.744 91 |
| $n_g$              | 0.435 835 | 1.745 88 |
| $n_h$              | 0.404 656 | 1.751 99 |
| $n_i$              | 0.365 015 | 1.762 43 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.739 975 77E-01 |
| $A_2$                           | 9.581 863 22E-01 |
| $A_3$                           | 1.201 633 59E+00 |
| $B_1$                           | 3.793 326 78E-03 |
| $B_2$                           | 1.775 745 81E-02 |
| $B_3$                           | 8.379 896 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 52.0 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 119.8 |
| Rigidity Modulus G (GPa) | 46.3  |
| Poisson's Ratio $\sigma$ | 0.295 |
| Knoop Hardness Hk[Class] | 720 7 |
| Abrasion Aa              | 65    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 088 |
| $n_C - n_{A'}$      | 0.004 686 |
| $n_d - n_C$         | 0.004 099 |
| $n_e - n_C$         | 0.007 312 |
| $n_g - n_d$         | 0.016 725 |
| $n_g - n_F$         | 0.007 344 |
| $n_h - n_g$         | 0.006 108 |
| $n_i - n_g$         | 0.016 544 |
| $n_{C'} - n_t$      | 0.011 740 |
| $n_e - n_{C'}$      | 0.006 660 |
| $n_{F'} - n_e$      | 0.006 936 |
| $n_i - n_{F'}$      | 0.023 120 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.822 6 |
| $\theta_{C,A'}$              | 0.347 6 |
| $\theta_{d,C}$               | 0.304 1 |
| $\theta_{e,C}$               | 0.542 4 |
| $\theta_{g,d}$               | 1.240 7 |
| $\theta_{g,F}$               | 0.544 8 |
| $\theta_{h,g}$               | 0.453 1 |
| $\theta_{i,g}$               | 1.227 3 |
| $\theta'_{C,t}$              | 0.863 5 |
| $\theta'_{e,C'}$             | 0.489 8 |
| $\theta'_{F,e}$              | 0.510 2 |
| $\theta'_{i,F'}$             | 1.700 5 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.022 1  |
| $\Delta\theta_{C,A'}$ | 0.006 2  |
| $\Delta\theta_{g,d}$  | -0.011 7 |
| $\Delta\theta_{g,F}$  | -0.009 2 |
| $\Delta\theta_{i,g}$  | -0.044 8 |

| Coloring              |      |                  |  |
|-----------------------|------|------------------|--|
| $\lambda_{80}$        | 355  | $\lambda_5$      |  |
| $\lambda_{70}$        |      |                  |  |
|                       |      |                  |  |
| Internal transmission |      |                  |  |
| $\lambda_{0.80}$      | 327  | $\lambda_{0.05}$ |  |
|                       |      |                  |  |
| CCI                   |      |                  |  |
| B                     | G    | R                |  |
| 0.00                  | 0.21 | 0.21             |  |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.29             |
| 290                    | 0.43             |
| 300                    | 0.55             |
| 310                    | 0.66             |
| 320                    | 0.75             |
| 330                    | 0.82             |
| 340                    | 0.88             |
| 350                    | 0.925            |
| 360                    | 0.953            |
| 370                    | 0.970            |
| 380                    | 0.980            |
| 390                    | 0.986            |
| 400                    | 0.990            |
| 420                    | 0.993            |
| 440                    | 0.995            |
| 460                    | 0.997            |
| 480                    | 0.998            |
| 500                    | 0.999            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.993            |
| 1 600                  | 0.993            |
| 1 800                  | 0.981            |
| 2 000                  | 0.951            |
| 2 200                  | 0.85             |
| 2 400                  | 0.58             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 610   |
| Annealing Point AP (°C)                                          | 634   |
| Transformation Temperature Tg (°C)                               | 657   |
| Yield Point At (°C)                                              | 690   |
| Softening Point SP (°C)                                          | 708   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 56    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 70    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.895 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 43                                             |
| -90 ~ -80                               | 44                                             |
| -80 ~ -70                               | 45                                             |
| -70 ~ -60                               | 47                                             |
| -60 ~ -50                               | 48                                             |
| -50 ~ -40                               | 49                                             |
| -40 ~ -30                               | 50                                             |
| -30 ~ -20                               | 52                                             |
| -20 ~ -10                               | 53                                             |
| -10 ~ 0                                 | 54                                             |
| 0 ~ 10                                  | 55                                             |
| 10 ~ 20                                 | 56                                             |
| 20 ~ 30                                 | 57                                             |
| 30 ~ 40                                 | 58                                             |
| 40 ~ 50                                 | 59                                             |
| 50 ~ 60                                 | 60                                             |
| 60 ~ 70                                 | 61                                             |
| 70 ~ 80                                 | 62                                             |
| 80 ~ 90                                 | 63                                             |
| 90 ~ 100                                | 63                                             |
| 100 ~ 110                               | 64                                             |
| 110 ~ 120                               | 65                                             |
| 120 ~ 130                               | 66                                             |
| 130 ~ 140                               | 66                                             |
| 140 ~ 150                               | 67                                             |
| 150 ~ 160                               | 68                                             |
| 160 ~ 170                               | 68                                             |
| 170 ~ 180                               | 69                                             |
| 180 ~ 190                               | 69                                             |
| 190 ~ 200                               | 70                                             |
| 200 ~ 210                               | 70                                             |
| 210 ~ 220                               | 71                                             |
| 220 ~ 230                               | 71                                             |
| 230 ~ 240                               | 72                                             |
| 240 ~ 250                               | 72                                             |
| 250 ~ 260                               | 72                                             |
| 260 ~ 270                               | 72                                             |
| 270 ~ 280                               | 73                                             |
| 280 ~ 290                               | 73                                             |
| 290 ~ 300                               | 73                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.61 |
| Specific Gravity $d$                                     | 3.98 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 3.3                                                             | 3.4 | 3.7 | 3.7 | 3.8 | 4.0 | 4.1 | 4.4 | 4.4 | 4.8 | 5.2 | 5.8 |
| -60 ~ -40                                    | 3.1                                                             | 3.2 | 3.6 | 3.7 | 3.7 | 3.9 | 4.0 | 4.3 | 4.3 | 4.7 | 5.1 | 5.7 |
| -40 ~ -20                                    | 3.1                                                             | 3.3 | 3.5 | 3.6 | 3.6 | 3.8 | 3.9 | 4.3 | 4.4 | 4.7 | 5.1 | 5.8 |
| -20 ~ 0                                      | 3.2                                                             | 3.3 | 3.6 | 3.7 | 3.8 | 3.9 | 4.1 | 4.4 | 4.4 | 4.9 | 5.2 | 5.9 |
| 0 ~ 20                                       | 3.3                                                             | 3.4 | 3.7 | 3.8 | 3.8 | 4.0 | 4.2 | 4.5 | 4.5 | 5.0 | 5.4 | 6.1 |
| 20 ~ 40                                      | 3.4                                                             | 3.5 | 3.8 | 3.9 | 4.0 | 4.1 | 4.3 | 4.6 | 4.7 | 5.1 | 5.6 | 6.3 |
| 40 ~ 60                                      | 3.5                                                             | 3.7 | 4.0 | 4.1 | 4.1 | 4.3 | 4.4 | 4.8 | 4.9 | 5.3 | 5.7 | 6.5 |
| 60 ~ 80                                      | 3.5                                                             | 3.8 | 4.2 | 4.3 | 4.3 | 4.5 | 4.6 | 5.0 | 5.0 | 5.5 | 5.9 | 6.7 |
| 80 ~ 100                                     | 3.7                                                             | 3.9 | 4.2 | 4.3 | 4.5 | 4.5 | 4.8 | 5.2 | 5.2 | 5.7 | 6.1 | 6.9 |
| 100 ~ 120                                    | 3.8                                                             | 4.0 | 4.4 | 4.5 | 4.5 | 4.7 | 5.0 | 5.3 | 5.3 | 5.8 | 6.3 | 7.1 |
| 120 ~ 140                                    | 3.9                                                             | 4.1 | 4.5 | 4.6 | 4.6 | 4.9 | 5.0 | 5.5 | 5.5 | 6.0 | 6.4 | 7.3 |
| 140 ~ 160                                    | 4.1                                                             | 4.3 | 4.7 | 4.8 | 4.8 | 5.0 | 5.2 | 5.6 | 5.6 | 6.1 | 6.6 | 7.5 |
| 160 ~ 180                                    | 4.1                                                             | 4.3 | 4.7 | 4.8 | 4.9 | 5.1 | 5.3 | 5.7 | 5.7 | 6.2 | 6.7 | 7.6 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.699 30<br>1.699 300 | Abbe Number $\nu_d$ | 51.11 | Dispersion $n_F - n_C$       | 0.013 682 |
| Refractive Index $n_e$ | 1.702 559             | Abbe Number $\nu_e$ | 50.82 | Dispersion $n_{F'} - n_{C'}$ | 0.013 825 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.668 04 |
| $n_{1970}$         | 1.970 09  | 1.672 70 |
| $n_{1530}$         | 1.529 58  | 1.677 91 |
| $n_{1129}$         | 1.128 64  | 1.682 97 |
| $n_t$              | 1.013 98  | 1.684 81 |
| $n_s$              | 0.852 11  | 1.688 20 |
| $n_{A'}$           | 0.768 19  | 1.690 63 |
| $n_F$              | 0.706 52  | 1.692 90 |
| $n_C$              | 0.656 27  | 1.695 20 |
| $n_{C'}$           | 0.643 85  | 1.695 84 |
| $n_{He-Ne}$        | 0.632 8   | 1.696 45 |
| $n_D$              | 0.589 29  | 1.699 18 |
| $n_d$              | 0.587 56  | 1.699 30 |
| $n_e$              | 0.546 07  | 1.702 56 |
| $n_F$              | 0.486 13  | 1.708 88 |
| $n_{F'}$           | 0.479 99  | 1.709 67 |
| $n_{He-Cd}$        | 0.441 57  | 1.715 46 |
| $n_g$              | 0.435 835 | 1.716 47 |
| $n_h$              | 0.404 656 | 1.722 83 |
| $n_i$              | 0.365 015 | 1.733 76 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.067 884 67E+00 |
| $A_2$                           | 7.587 353 50E-01 |
| $A_3$                           | 1.028 046 82E+00 |
| $B_1$                           | 5.188 960 58E-03 |
| $B_2$                           | 2.040 043 57E-02 |
| $B_3$                           | 1.208 263 20E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 2    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 53.1 |
| Phosphate Resistance PR                   | 4.2  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 78.7  |
| Rigidity Modulus G (GPa) | 30.2  |
| Poisson's Ratio $\sigma$ | 0.302 |
| Knoop Hardness Hk[Class] | 490 5 |
| Abrasion Aa              | 254   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 389 |
| $n_C - n_{A'}$      | 0.004 570 |
| $n_d - n_C$         | 0.004 104 |
| $n_e - n_C$         | 0.007 363 |
| $n_g - n_d$         | 0.017 174 |
| $n_g - n_F$         | 0.007 596 |
| $n_h - n_g$         | 0.006 359 |
| $n_i - n_g$         | 0.017 290 |
| $n_{C'} - n_t$      | 0.011 038 |
| $n_e - n_{C'}$      | 0.006 714 |
| $n_{F'} - n_e$      | 0.007 111 |
| $n_i - n_{F'}$      | 0.024 094 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.759 3 |
| $\theta_{C,A'}$              | 0.334 0 |
| $\theta_{d,C}$               | 0.300 0 |
| $\theta_{e,C}$               | 0.538 2 |
| $\theta_{g,d}$               | 1.255 2 |
| $\theta_{g,F}$               | 0.555 2 |
| $\theta_{h,g}$               | 0.464 8 |
| $\theta_{i,g}$               | 1.263 7 |
| $\theta'_{C,t}$              | 0.798 4 |
| $\theta'_{e,C'}$             | 0.485 6 |
| $\theta'_{F,e}$              | 0.514 4 |
| $\theta'_{i,F'}$             | 1.742 8 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.027 2 |
| $\Delta\theta_{C,A'}$ | -0.003 8 |
| $\Delta\theta_{g,d}$  | -0.003 4 |
| $\Delta\theta_{g,F}$  | -0.003 6 |
| $\Delta\theta_{i,g}$  | -0.033 3 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 370  | $\lambda_5$      | 310 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 350  | $\lambda_{0.05}$ | 305 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.40 | 0.36             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    | 0.01             |
| 310                    | 0.09             |
| 320                    | 0.27             |
| 330                    | 0.49             |
| 340                    | 0.67             |
| 350                    | 0.80             |
| 360                    | 0.88             |
| 370                    | 0.934            |
| 380                    | 0.960            |
| 390                    | 0.974            |
| 400                    | 0.982            |
| 420                    | 0.987            |
| 440                    | 0.987            |
| 460                    | 0.989            |
| 480                    | 0.992            |
| 500                    | 0.994            |
| 550                    | 0.996            |
| 600                    | 0.995            |
| 650                    | 0.994            |
| 700                    | 0.996            |
| 800                    | 0.998            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.998            |
| 1 400                  | 0.997            |
| 1 600                  | 0.995            |
| 1 800                  | 0.985            |
| 2 000                  | 0.969            |
| 2 200                  | 0.935            |
| 2 400                  | 0.84             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 593   |
| Annealing Point AP (°C)                                          | 621   |
| Transformation Temperature Tg (°C)                               | 633   |
| Yield Point At (°C)                                              | 680   |
| Softening Point SP (°C)                                          | 717   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 93    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 107   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.602 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 81                                             |
| -90 ~ -80                               | 82                                             |
| -80 ~ -70                               | 83                                             |
| -70 ~ -60                               | 84                                             |
| -60 ~ -50                               | 85                                             |
| -50 ~ -40                               | 86                                             |
| -40 ~ -30                               | 87                                             |
| -30 ~ -20                               | 88                                             |
| -20 ~ -10                               | 89                                             |
| -10 ~ 0                                 | 90                                             |
| 0 ~ 10                                  | 91                                             |
| 10 ~ 20                                 | 92                                             |
| 20 ~ 30                                 | 93                                             |
| 30 ~ 40                                 | 94                                             |
| 40 ~ 50                                 | 95                                             |
| 50 ~ 60                                 | 96                                             |
| 60 ~ 70                                 | 97                                             |
| 70 ~ 80                                 | 98                                             |
| 80 ~ 90                                 | 99                                             |
| 90 ~ 100                                | 99                                             |
| 100 ~ 110                               | 100                                            |
| 110 ~ 120                               | 101                                            |
| 120 ~ 130                               | 102                                            |
| 130 ~ 140                               | 103                                            |
| 140 ~ 150                               | 103                                            |
| 150 ~ 160                               | 104                                            |
| 160 ~ 170                               | 105                                            |
| 170 ~ 180                               | 105                                            |
| 180 ~ 190                               | 106                                            |
| 190 ~ 200                               | 107                                            |
| 200 ~ 210                               | 107                                            |
| 210 ~ 220                               | 108                                            |
| 220 ~ 230                               | 108                                            |
| 230 ~ 240                               | 109                                            |
| 240 ~ 250                               | 110                                            |
| 250 ~ 260                               | 110                                            |
| 260 ~ 270                               | 111                                            |
| 270 ~ 280                               | 111                                            |
| 280 ~ 290                               | 112                                            |
| 290 ~ 300                               | 112                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.23 |
| Specific Gravity $d$                                     | 4.38 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |     |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |     |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i   |
| -80 ~ -60                                    | -2.5                                                            | -2.3 | -2.0 | -1.9 | -1.8 | -1.7 | -1.5 | -1.2 | -1.1 | -0.7 | -0.3 | 0.6 |
| -60 ~ -40                                    | -2.5                                                            | -2.4 | -2.1 | -2.0 | -2.0 | -1.8 | -1.6 | -1.2 | -1.2 | -0.8 | -0.4 | 0.5 |
| -40 ~ -20                                    | -2.6                                                            | -2.4 | -2.1 | -2.0 | -2.0 | -1.8 | -1.6 | -1.3 | -1.3 | -0.8 | -0.3 | 0.5 |
| -20 ~ 0                                      | -2.6                                                            | -2.4 | -2.0 | -1.9 | -1.9 | -1.7 | -1.5 | -1.2 | -1.2 | -0.7 | -0.3 | 0.6 |
| 0 ~ 20                                       | -2.4                                                            | -2.3 | -2.0 | -1.9 | -1.8 | -1.7 | -1.5 | -1.1 | -1.1 | -0.7 | -0.1 | 0.7 |
| 20 ~ 40                                      | -2.4                                                            | -2.3 | -1.9 | -1.8 | -1.7 | -1.6 | -1.4 | -1.0 | -1.0 | -0.5 | -0.1 | 0.9 |
| 40 ~ 60                                      | -2.3                                                            | -2.1 | -1.8 | -1.7 | -1.7 | -1.5 | -1.3 | -0.9 | -0.9 | -0.4 | 0.1  | 1.0 |
| 60 ~ 80                                      | -2.2                                                            | -2.1 | -1.7 | -1.5 | -1.6 | -1.3 | -1.1 | -0.8 | -0.7 | -0.3 | 0.2  | 1.1 |
| 80 ~ 100                                     | -2.1                                                            | -2.0 | -1.7 | -1.5 | -1.5 | -1.3 | -1.0 | -0.7 | -0.6 | -0.1 | 0.3  | 1.2 |
| 100 ~ 120                                    | -2.1                                                            | -1.9 | -1.6 | -1.5 | -1.4 | -1.2 | -1.1 | -0.7 | -0.6 | -0.1 | 0.4  | 1.3 |
| 120 ~ 140                                    | -2.0                                                            | -1.9 | -1.5 | -1.4 | -1.4 | -1.2 | -1.0 | -0.6 | -0.6 | 0.0  | 0.5  | 1.4 |
| 140 ~ 160                                    | -2.1                                                            | -1.9 | -1.4 | -1.3 | -1.3 | -1.1 | -0.9 | -0.5 | -0.4 | 0.0  | 0.5  | 1.5 |
| 160 ~ 180                                    | -2.0                                                            | -1.8 | -1.5 | -1.4 | -1.3 | -1.1 | -0.9 | -0.5 | -0.5 | 0.0  | 0.5  | 1.5 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.703 00<br>1.703 000 | Abbe Number $\nu_d$ | 52.38 | Dispersion $n_F - n_C$       | 0.013 422 |
| Refractive Index $n_e$ | 1.706 198             | Abbe Number $\nu_e$ | 52.11 | Dispersion $n_{F'} - n_{C'}$ | 0.013 553 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.669 40 |
| $n_{1970}$         | 1.970 09  | 1.674 90 |
| $n_{1530}$         | 1.529 58  | 1.680 93 |
| $n_{1129}$         | 1.128 64  | 1.686 52 |
| $n_t$              | 1.013 98  | 1.688 46 |
| $n_s$              | 0.852 11  | 1.691 95 |
| $n_{A'}$           | 0.768 19  | 1.694 40 |
| $n_F$              | 0.706 52  | 1.696 67 |
| $n_C$              | 0.656 27  | 1.698 95 |
| $n_{C'}$           | 0.643 85  | 1.699 59 |
| $n_{He-Ne}$        | 0.632 8   | 1.700 19 |
| $n_D$              | 0.589 29  | 1.702 88 |
| $n_d$              | 0.587 56  | 1.703 00 |
| $n_e$              | 0.546 07  | 1.706 20 |
| $n_F$              | 0.486 13  | 1.712 37 |
| $n_{F'}$           | 0.479 99  | 1.713 15 |
| $n_{He-Cd}$        | 0.441 57  | 1.718 78 |
| $n_g$              | 0.435 835 | 1.719 76 |
| $n_h$              | 0.404 656 | 1.725 93 |
| $n_i$              | 0.365 015 | 1.736 49 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.352 507 79E-01 |
| $A_2$                           | 9.059 887 06E-01 |
| $A_3$                           | 1.433 512 12E+00 |
| $B_1$                           | 1.808 360 47E-02 |
| $B_2$                           | 4.084 526 43E-03 |
| $B_3$                           | 1.386 834 10E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 112.9 |
| Rigidity Modulus G (GPa) | 43.6  |
| Poisson's Ratio $\sigma$ | 0.293 |
| Knoop Hardness Hk[Class] | 700 7 |
| Abrasion Aa              | 60    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 494 |
| $n_C - n_{A'}$      | 0.004 551 |
| $n_d - n_C$         | 0.004 048 |
| $n_e - n_C$         | 0.007 246 |
| $n_g - n_d$         | 0.016 764 |
| $n_g - n_F$         | 0.007 390 |
| $n_h - n_g$         | 0.006 165 |
| $n_i - n_g$         | 0.016 723 |
| $n_{C'} - n_t$      | 0.011 135 |
| $n_e - n_{C'}$      | 0.006 605 |
| $n_{F'} - n_e$      | 0.006 948 |
| $n_i - n_{F'}$      | 0.023 341 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.781 9 |
| $\theta_{C,A'}$              | 0.339 1 |
| $\theta_{d,C}$               | 0.301 6 |
| $\theta_{e,C}$               | 0.539 9 |
| $\theta_{g,d}$               | 1.249 0 |
| $\theta_{g,F}$               | 0.550 6 |
| $\theta_{h,g}$               | 0.459 3 |
| $\theta_{i,g}$               | 1.245 9 |
| $\theta'_{C,t}$              | 0.821 6 |
| $\theta'_{e,C'}$             | 0.487 3 |
| $\theta'_{F,e}$              | 0.512 7 |
| $\theta'_{i,F'}$             | 1.722 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.010 5 |
| $\Delta\theta_{C,A'}$ | -0.000 3 |
| $\Delta\theta_{g,d}$  | -0.006 9 |
| $\Delta\theta_{g,F}$  | -0.006 1 |
| $\Delta\theta_{i,g}$  | -0.040 5 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 395  | $\lambda_5$      | 320 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 374  | $\lambda_{0.05}$ | 320 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.01 | 0.99             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.01             |
| 320                    | 0.05             |
| 330                    | 0.15             |
| 340                    | 0.30             |
| 350                    | 0.48             |
| 360                    | 0.65             |
| 370                    | 0.77             |
| 380                    | 0.85             |
| 390                    | 0.909            |
| 400                    | 0.942            |
| 420                    | 0.975            |
| 440                    | 0.986            |
| 460                    | 0.991            |
| 480                    | 0.994            |
| 500                    | 0.996            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.996            |
| 800                    | 0.995            |
| 900                    | 0.992            |
| 1 000                  | 0.991            |
| 1 200                  | 0.992            |
| 1 400                  | 0.989            |
| 1 600                  | 0.992            |
| 1 800                  | 0.987            |
| 2 000                  | 0.979            |
| 2 200                  | 0.949            |
| 2 400                  | 0.87             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 769   |
| Yield Point At (°C)                                              | 823   |
| Softening Point SP (°C)                                          | 879   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 51    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 64    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.983 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 39                                             |
| -90 ~ -80                               | 40                                             |
| -80 ~ -70                               | 41                                             |
| -70 ~ -60                               | 42                                             |
| -60 ~ -50                               | 44                                             |
| -50 ~ -40                               | 45                                             |
| -40 ~ -30                               | 46                                             |
| -30 ~ -20                               | 47                                             |
| -20 ~ -10                               | 48                                             |
| -10 ~ 0                                 | 49                                             |
| 0 ~ 10                                  | 50                                             |
| 10 ~ 20                                 | 51                                             |
| 20 ~ 30                                 | 52                                             |
| 30 ~ 40                                 | 53                                             |
| 40 ~ 50                                 | 54                                             |
| 50 ~ 60                                 | 54                                             |
| 60 ~ 70                                 | 55                                             |
| 70 ~ 80                                 | 56                                             |
| 80 ~ 90                                 | 57                                             |
| 90 ~ 100                                | 58                                             |
| 100 ~ 110                               | 58                                             |
| 110 ~ 120                               | 59                                             |
| 120 ~ 130                               | 60                                             |
| 130 ~ 140                               | 60                                             |
| 140 ~ 150                               | 61                                             |
| 150 ~ 160                               | 62                                             |
| 160 ~ 170                               | 62                                             |
| 170 ~ 180                               | 63                                             |
| 180 ~ 190                               | 63                                             |
| 190 ~ 200                               | 64                                             |
| 200 ~ 210                               | 64                                             |
| 210 ~ 220                               | 65                                             |
| 220 ~ 230                               | 65                                             |
| 230 ~ 240                               | 66                                             |
| 240 ~ 250                               | 66                                             |
| 250 ~ 260                               | 66                                             |
| 260 ~ 270                               | 67                                             |
| 270 ~ 280                               | 67                                             |
| 280 ~ 290                               | 67                                             |
| 290 ~ 300                               | 68                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.64 |
| Specific Gravity $d$                                     | 3.85 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 5.9                                                             | 6.1 | 6.5 | 6.6 | 6.6 | 6.8 | 6.9 | 7.4 | 7.4 | 7.8 | 8.2 | 9.0  |
| -60 ~ -40                                    | 5.8                                                             | 6.0 | 6.3 | 6.4 | 6.5 | 6.6 | 6.9 | 7.2 | 7.3 | 7.7 | 8.1 | 9.0  |
| -40 ~ -20                                    | 5.7                                                             | 6.0 | 6.3 | 6.4 | 6.5 | 6.7 | 6.8 | 7.2 | 7.2 | 7.7 | 8.2 | 9.0  |
| -20 ~ 0                                      | 5.8                                                             | 6.0 | 6.4 | 6.5 | 6.6 | 6.8 | 6.9 | 7.3 | 7.3 | 7.8 | 8.2 | 9.1  |
| 0 ~ 20                                       | 5.9                                                             | 6.1 | 6.5 | 6.6 | 6.6 | 6.8 | 7.0 | 7.4 | 7.4 | 7.9 | 8.4 | 9.3  |
| 20 ~ 40                                      | 5.9                                                             | 6.2 | 6.6 | 6.7 | 6.8 | 7.0 | 7.2 | 7.5 | 7.6 | 8.1 | 8.5 | 9.5  |
| 40 ~ 60                                      | 6.1                                                             | 6.3 | 6.7 | 6.8 | 6.9 | 7.1 | 7.3 | 7.7 | 7.7 | 8.2 | 8.7 | 9.7  |
| 60 ~ 80                                      | 6.2                                                             | 6.4 | 6.9 | 7.0 | 7.0 | 7.3 | 7.5 | 7.9 | 7.9 | 8.4 | 8.9 | 9.8  |
| 80 ~ 100                                     | 6.3                                                             | 6.5 | 6.9 | 7.1 | 7.1 | 7.3 | 7.5 | 8.0 | 8.0 | 8.6 | 9.1 | 10.1 |
| 100 ~ 120                                    | 6.4                                                             | 6.6 | 7.1 | 7.2 | 7.2 | 7.5 | 7.7 | 8.1 | 8.2 | 8.7 | 9.3 | 10.3 |
| 120 ~ 140                                    | 6.5                                                             | 6.7 | 7.1 | 7.3 | 7.3 | 7.6 | 7.8 | 8.2 | 8.3 | 8.9 | 9.4 | 10.4 |
| 140 ~ 160                                    | 6.5                                                             | 6.8 | 7.3 | 7.4 | 7.5 | 7.7 | 7.9 | 8.4 | 8.5 | 9.0 | 9.5 | 10.6 |
| 160 ~ 180                                    | 6.6                                                             | 6.9 | 7.3 | 7.5 | 7.5 | 7.8 | 8.0 | 8.5 | 8.5 | 9.1 | 9.6 | 10.7 |

## S-LAL54Q

Code(d) **651562**  
Code(e) **654560**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.651 00</b><br>1.651 000 | Abbe Number $\nu_d$ | <b>56.24</b> | Dispersion $n_F - n_C$       | <b>0.011 576</b> |
| Refractive Index $n_e$ | 1.653 761                    | Abbe Number $\nu_e$ | 56.02        | Dispersion $n_{F'} - n_{C'}$ | 0.011 670        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.615 32 |
| $n_{1970}$         | 1.970 09  | 1.622 34 |
| $n_{1530}$         | 1.529 58  | 1.629 66 |
| $n_{1129}$         | 1.128 64  | 1.635 84 |
| $n_t$              | 1.013 98  | 1.637 81 |
| $n_s$              | 0.852 11  | 1.641 17 |
| $n_{A'}$           | 0.768 19  | 1.643 41 |
| $n_F$              | 0.706 52  | 1.645 45 |
| $n_C$              | 0.656 27  | 1.647 47 |
| $n_{C'}$           | 0.643 85  | 1.648 03 |
| $n_{He-Ne}$        | 0.632 8   | 1.648 56 |
| $n_D$              | 0.589 29  | 1.650 90 |
| $n_d$              | 0.587 56  | 1.651 00 |
| $n_e$              | 0.546 07  | 1.653 76 |
| $n_F$              | 0.486 13  | 1.659 05 |
| $n_{F'}$           | 0.479 99  | 1.659 70 |
| $n_{He-Cd}$        | 0.441 57  | 1.664 49 |
| $n_g$              | 0.435 835 | 1.665 32 |
| $n_h$              | 0.404 656 | 1.670 53 |
| $n_i$              | 0.365 015 | 1.679 39 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 9.200 850 87E-01 |
| $A_2$                           | 7.586 461 15E-01 |
| $A_3$                           | 1.070 730 96E+00 |
| $B_1$                           | 1.608 296 67E-02 |
| $B_2$                           | 2.920 593 06E-03 |
| $B_3$                           | 8.512 112 00E+01 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 3.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 101.9 |
| Rigidity Modulus G (GPa) | 39.6  |
| Poisson's Ratio $\sigma$ | 0.287 |
| Knoop Hardness Hk[Class] | 670 7 |
| Abrasion Aa              | 61    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.009 660 |
| $n_C - n_{A'}$      | 0.004 056 |
| $n_d - n_C$         | 0.003 530 |
| $n_e - n_C$         | 0.006 291 |
| $n_g - n_d$         | 0.014 320 |
| $n_g - n_F$         | 0.006 274 |
| $n_h - n_g$         | 0.005 206 |
| $n_i - n_g$         | 0.014 075 |
| $n_{C'} - n_t$      | 0.010 223 |
| $n_e - n_{C'}$      | 0.005 728 |
| $n_{F'} - n_e$      | 0.005 942 |
| $n_i - n_{F'}$      | 0.019 692 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.834 5 |
| $\theta_{C,A'}$              | 0.350 4 |
| $\theta_{d,C}$               | 0.304 9 |
| $\theta_{e,C}$               | 0.543 5 |
| $\theta_{g,d}$               | 1.237 0 |
| $\theta_{g,F}$               | 0.542 0 |
| $\theta_{h,g}$               | 0.449 7 |
| $\theta_{i,g}$               | 1.215 9 |
| $\theta'_{C,t}$              | 0.876 0 |
| $\theta'_{e,C'}$             | 0.490 8 |
| $\theta'_{F,e}$              | 0.509 2 |
| $\theta'_{i,F'}$             | 1.687 4 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.023 9  |
| $\Delta\theta_{C,A'}$ | 0.006 4  |
| $\Delta\theta_{g,d}$  | -0.010 9 |
| $\Delta\theta_{g,F}$  | -0.008 5 |
| $\Delta\theta_{i,g}$  | -0.038 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 385  | $\lambda_5$      |     |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 367  | $\lambda_{0.05}$ | 311 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.62 | 0.63             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.04             |
| 320                    | 0.11             |
| 330                    | 0.24             |
| 340                    | 0.41             |
| 350                    | 0.58             |
| 360                    | 0.73             |
| 370                    | 0.83             |
| 380                    | 0.90             |
| 390                    | 0.938            |
| 400                    | 0.962            |
| 420                    | 0.984            |
| 440                    | 0.991            |
| 460                    | 0.995            |
| 480                    | 0.997            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.998            |
| 700                    | 0.997            |
| 800                    | 0.997            |
| 900                    | 0.995            |
| 1 000                  | 0.993            |
| 1 200                  | 0.994            |
| 1 400                  | 0.976            |
| 1 600                  | 0.986            |
| 1 800                  | 0.973            |
| 2 000                  | 0.942            |
| 2 200                  | 0.81             |
| 2 400                  | 0.58             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 646   |
| Annealing Point AP (°C)                                          | 679   |
| Transformation Temperature Tg (°C)                               | 688   |
| Yield Point At (°C)                                              | 725   |
| Softening Point SP (°C)                                          | 748   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 46    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 57    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.921 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 34                                             |
| -90 ~ -80                               | 35                                             |
| -80 ~ -70                               | 36                                             |
| -70 ~ -60                               | 37                                             |
| -60 ~ -50                               | 38                                             |
| -50 ~ -40                               | 39                                             |
| -40 ~ -30                               | 40                                             |
| -30 ~ -20                               | 41                                             |
| -20 ~ -10                               | 42                                             |
| -10 ~ 0                                 | 43                                             |
| 0 ~ 10                                  | 44                                             |
| 10 ~ 20                                 | 45                                             |
| 20 ~ 30                                 | 46                                             |
| 30 ~ 40                                 | 47                                             |
| 40 ~ 50                                 | 48                                             |
| 50 ~ 60                                 | 48                                             |
| 60 ~ 70                                 | 49                                             |
| 70 ~ 80                                 | 50                                             |
| 80 ~ 90                                 | 51                                             |
| 90 ~ 100                                | 51                                             |
| 100 ~ 110                               | 52                                             |
| 110 ~ 120                               | 53                                             |
| 120 ~ 130                               | 53                                             |
| 130 ~ 140                               | 54                                             |
| 140 ~ 150                               | 55                                             |
| 150 ~ 160                               | 55                                             |
| 160 ~ 170                               | 56                                             |
| 170 ~ 180                               | 56                                             |
| 180 ~ 190                               | 57                                             |
| 190 ~ 200                               | 57                                             |
| 200 ~ 210                               | 58                                             |
| 210 ~ 220                               | 58                                             |
| 220 ~ 230                               | 59                                             |
| 230 ~ 240                               | 59                                             |
| 240 ~ 250                               | 59                                             |
| 250 ~ 260                               | 60                                             |
| 260 ~ 270                               | 60                                             |
| 270 ~ 280                               | 60                                             |
| 280 ~ 290                               | 61                                             |
| 290 ~ 300                               | 61                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.17 |
| Specific Gravity $d$                                     | 3.36 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 4.9                                                             | 5.1 | 5.4 | 5.5 | 5.5 | 5.6 | 5.8 | 6.1 | 6.2 | 6.5 | 6.8 | 7.4 |
| -60 ~ -40                                    | 4.8                                                             | 5.0 | 5.2 | 5.3 | 5.5 | 5.6 | 5.7 | 6.0 | 6.1 | 6.4 | 6.7 | 7.3 |
| -40 ~ -20                                    | 4.8                                                             | 5.0 | 5.3 | 5.4 | 5.4 | 5.6 | 5.8 | 6.1 | 6.1 | 6.4 | 6.7 | 7.3 |
| -20 ~ 0                                      | 4.9                                                             | 5.1 | 5.4 | 5.5 | 5.5 | 5.7 | 5.8 | 6.1 | 6.1 | 6.5 | 6.9 | 7.4 |
| 0 ~ 20                                       | 5.0                                                             | 5.2 | 5.5 | 5.6 | 5.6 | 5.9 | 6.0 | 6.3 | 6.3 | 6.7 | 7.0 | 7.6 |
| 20 ~ 40                                      | 5.2                                                             | 5.3 | 5.6 | 5.7 | 5.8 | 5.9 | 6.1 | 6.5 | 6.5 | 6.8 | 7.2 | 7.7 |
| 40 ~ 60                                      | 5.3                                                             | 5.4 | 5.8 | 6.0 | 6.0 | 6.1 | 6.3 | 6.6 | 6.6 | 7.0 | 7.3 | 7.9 |
| 60 ~ 80                                      | 5.4                                                             | 5.6 | 5.9 | 6.0 | 6.1 | 6.2 | 6.4 | 6.7 | 6.7 | 7.1 | 7.5 | 8.1 |
| 80 ~ 100                                     | 5.6                                                             | 5.8 | 6.1 | 6.2 | 6.2 | 6.4 | 6.5 | 6.9 | 6.9 | 7.2 | 7.6 | 8.3 |
| 100 ~ 120                                    | 5.7                                                             | 5.9 | 6.2 | 6.3 | 6.4 | 6.5 | 6.7 | 7.0 | 7.0 | 7.4 | 7.7 | 8.3 |
| 120 ~ 140                                    | 5.8                                                             | 6.0 | 6.3 | 6.4 | 6.4 | 6.6 | 6.8 | 7.1 | 7.1 | 7.5 | 7.8 | 8.5 |
| 140 ~ 160                                    | 5.8                                                             | 6.0 | 6.4 | 6.5 | 6.5 | 6.7 | 6.8 | 7.2 | 7.2 | 7.7 | 8.0 | 8.6 |
| 160 ~ 180                                    | 6.0                                                             | 6.2 | 6.5 | 6.6 | 6.6 | 6.8 | 7.0 | 7.3 | 7.3 | 7.7 | 8.1 | 8.7 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.693 50<br>1.693 495 | Abbe Number $\nu_d$ | 50.81 | Dispersion $n_F - n_C$       | 0.013 649 |
| Refractive Index $n_e$ | 1.696 745             | Abbe Number $\nu_e$ | 50.53 | Dispersion $n_{F'} - n_{C'}$ | 0.013 789 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.659 98 |
| $n_{1970}$         | 1.970 09  | 1.665 38 |
| $n_{1530}$         | 1.529 58  | 1.671 33 |
| $n_{1129}$         | 1.128 64  | 1.676 89 |
| $n_t$              | 1.013 98  | 1.678 83 |
| $n_s$              | 0.852 11  | 1.682 33 |
| $n_{A'}$           | 0.768 19  | 1.684 80 |
| $n_F$              | 0.706 52  | 1.687 09 |
| $n_C$              | 0.656 27  | 1.689 39 |
| $n_{C'}$           | 0.643 85  | 1.690 04 |
| $n_{He-Ne}$        | 0.632 8   | 1.690 65 |
| $n_D$              | 0.589 29  | 1.693 37 |
| $n_d$              | 0.587 56  | 1.693 50 |
| $n_e$              | 0.546 07  | 1.696 75 |
| $n_F$              | 0.486 13  | 1.703 04 |
| $n_{F'}$           | 0.479 99  | 1.703 83 |
| $n_{He-Cd}$        | 0.441 57  | 1.709 60 |
| $n_g$              | 0.435 835 | 1.710 61 |
| $n_h$              | 0.404 656 | 1.716 96 |
| $n_i$              | 0.365 015 | 1.727 88 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.063 687 89E+00 |
| $A_2$                           | 7.449 390 67E-01 |
| $A_3$                           | 1.591 789 42E+00 |
| $B_1$                           | 1.851 996 40E-02 |
| $B_2$                           | 1.162 958 62E-03 |
| $B_3$                           | 1.566 360 25E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 2.2  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 92.8  |
| Rigidity Modulus G (GPa) | 36.1  |
| Poisson's Ratio $\sigma$ | 0.285 |
| Knoop Hardness Hk[Class] | 580   |
| Abrasion Aa              | 158   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 565 |
| $n_C - n_{A'}$      | 0.004 596 |
| $n_d - n_C$         | 0.004 102 |
| $n_e - n_C$         | 0.007 352 |
| $n_g - n_d$         | 0.017 117 |
| $n_g - n_F$         | 0.007 570 |
| $n_h - n_g$         | 0.006 343 |
| $n_i - n_g$         | 0.017 264 |
| $n_{C'} - n_t$      | 0.011 214 |
| $n_e - n_{C'}$      | 0.006 703 |
| $n_{F'} - n_e$      | 0.007 086 |
| $n_i - n_{F'}$      | 0.024 045 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.774 0 |
| $\theta_{C,A'}$              | 0.336 7 |
| $\theta_{d,C}$               | 0.300 5 |
| $\theta_{e,C}$               | 0.538 6 |
| $\theta_{g,d}$               | 1.254 1 |
| $\theta_{g,F}$               | 0.554 6 |
| $\theta_{h,g}$               | 0.464 7 |
| $\theta_{i,g}$               | 1.264 9 |
| $\theta'_{C,t}$              | 0.813 3 |
| $\theta'_{e,C'}$             | 0.486 1 |
| $\theta'_{F,e}$              | 0.513 9 |
| $\theta'_{i,F'}$             | 1.743 8 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.011 1 |
| $\Delta\theta_{C,A'}$ | -0.000 8 |
| $\Delta\theta_{g,d}$  | -0.005 1 |
| $\Delta\theta_{g,F}$  | -0.004 7 |
| $\Delta\theta_{i,g}$  | -0.034 7 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 370  | $\lambda_5$      | 320 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 354  | $\lambda_{0.05}$ | 322 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.30 | 0.28             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    | 0.02             |
| 330                    | 0.22             |
| 340                    | 0.53             |
| 350                    | 0.75             |
| 360                    | 0.87             |
| 370                    | 0.935            |
| 380                    | 0.962            |
| 390                    | 0.977            |
| 400                    | 0.986            |
| 420                    | 0.991            |
| 440                    | 0.992            |
| 460                    | 0.994            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.989            |
| 2 000                  | 0.977            |
| 2 200                  | 0.942            |
| 2 400                  | 0.84             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 633   |
| Annealing Point AP (°C)                                          | 659   |
| Transformation Temperature Tg (°C)                               | 678   |
| Yield Point At (°C)                                              | 730   |
| Softening Point SP (°C)                                          | 770   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 74    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 87    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.728 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 62                                             |
| -90 ~ -80                               | 63                                             |
| -80 ~ -70                               | 64                                             |
| -70 ~ -60                               | 65                                             |
| -60 ~ -50                               | 67                                             |
| -50 ~ -40                               | 68                                             |
| -40 ~ -30                               | 69                                             |
| -30 ~ -20                               | 70                                             |
| -20 ~ -10                               | 71                                             |
| -10 ~ 0                                 | 72                                             |
| 0 ~ 10                                  | 73                                             |
| 10 ~ 20                                 | 74                                             |
| 20 ~ 30                                 | 75                                             |
| 30 ~ 40                                 | 76                                             |
| 40 ~ 50                                 | 77                                             |
| 50 ~ 60                                 | 78                                             |
| 60 ~ 70                                 | 79                                             |
| 70 ~ 80                                 | 79                                             |
| 80 ~ 90                                 | 80                                             |
| 90 ~ 100                                | 81                                             |
| 100 ~ 110                               | 82                                             |
| 110 ~ 120                               | 83                                             |
| 120 ~ 130                               | 83                                             |
| 130 ~ 140                               | 84                                             |
| 140 ~ 150                               | 85                                             |
| 150 ~ 160                               | 85                                             |
| 160 ~ 170                               | 86                                             |
| 170 ~ 180                               | 86                                             |
| 180 ~ 190                               | 87                                             |
| 190 ~ 200                               | 88                                             |
| 200 ~ 210                               | 88                                             |
| 210 ~ 220                               | 89                                             |
| 220 ~ 230                               | 89                                             |
| 230 ~ 240                               | 90                                             |
| 240 ~ 250                               | 90                                             |
| 250 ~ 260                               | 90                                             |
| 260 ~ 270                               | 91                                             |
| 270 ~ 280                               | 91                                             |
| 280 ~ 290                               | 91                                             |
| 290 ~ 300                               | 92                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.70 |
| Specific Gravity $d$                                     | 4.03 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 0.9                                                             | 1.0 | 1.4 | 1.5 | 1.5 | 1.7 | 1.8 | 2.2 | 2.2 | 2.7 | 3.1 | 3.9 |
| -60 ~ -40                                    | 0.8                                                             | 0.9 | 1.2 | 1.3 | 1.4 | 1.5 | 1.7 | 2.1 | 2.2 | 2.6 | 2.9 | 3.8 |
| -40 ~ -20                                    | 0.7                                                             | 0.9 | 1.2 | 1.3 | 1.4 | 1.5 | 1.7 | 2.1 | 2.1 | 2.6 | 3.0 | 3.8 |
| -20 ~ 0                                      | 0.7                                                             | 0.9 | 1.3 | 1.4 | 1.4 | 1.6 | 1.8 | 2.2 | 2.2 | 2.6 | 3.0 | 3.9 |
| 0 ~ 20                                       | 0.7                                                             | 1.0 | 1.4 | 1.5 | 1.5 | 1.7 | 1.9 | 2.2 | 2.3 | 2.7 | 3.3 | 4.1 |
| 20 ~ 40                                      | 0.8                                                             | 1.0 | 1.5 | 1.6 | 1.6 | 1.8 | 2.0 | 2.4 | 2.4 | 2.9 | 3.3 | 4.3 |
| 40 ~ 60                                      | 1.0                                                             | 1.2 | 1.6 | 1.7 | 1.7 | 1.9 | 2.1 | 2.5 | 2.6 | 3.0 | 3.5 | 4.5 |
| 60 ~ 80                                      | 1.1                                                             | 1.3 | 1.6 | 1.8 | 1.8 | 2.1 | 2.3 | 2.7 | 2.8 | 3.2 | 3.7 | 4.6 |
| 80 ~ 100                                     | 1.2                                                             | 1.4 | 1.8 | 1.9 | 1.9 | 2.1 | 2.3 | 2.8 | 2.8 | 3.4 | 3.9 | 4.8 |
| 100 ~ 120                                    | 1.3                                                             | 1.5 | 1.9 | 2.0 | 2.1 | 2.3 | 2.5 | 2.9 | 3.0 | 3.5 | 4.1 | 5.0 |
| 120 ~ 140                                    | 1.3                                                             | 1.6 | 2.0 | 2.1 | 2.1 | 2.4 | 2.6 | 3.0 | 3.1 | 3.7 | 4.2 | 5.2 |
| 140 ~ 160                                    | 1.4                                                             | 1.6 | 2.1 | 2.3 | 2.3 | 2.5 | 2.8 | 3.2 | 3.3 | 3.8 | 4.3 | 5.3 |
| 160 ~ 180                                    | 1.5                                                             | 1.7 | 2.2 | 2.3 | 2.3 | 2.6 | 2.8 | 3.3 | 3.3 | 3.9 | 4.4 | 5.4 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.734 00<br>1.733 997 | Abbe Number $\nu_d$ | 51.47 | Dispersion $n_F - n_C$       | 0.014 261 |
| Refractive Index $n_e$ | 1.737 395             | Abbe Number $\nu_e$ | 51.24 | Dispersion $n_{F'} - n_{C'}$ | 0.014 392 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.693 93 |
| $n_{1970}$         | 1.970 09  | 1.701 30 |
| $n_{1530}$         | 1.529 58  | 1.709 11 |
| $n_{1129}$         | 1.128 64  | 1.715 93 |
| $n_t$              | 1.013 98  | 1.718 17 |
| $n_s$              | 0.852 11  | 1.722 10 |
| $n_{A'}$           | 0.768 19  | 1.724 77 |
| $n_F$              | 0.706 52  | 1.727 23 |
| $n_C$              | 0.656 27  | 1.729 68 |
| $n_{C'}$           | 0.643 85  | 1.730 36 |
| $n_{He-Ne}$        | 0.632 8   | 1.731 01 |
| $n_D$              | 0.589 29  | 1.733 87 |
| $n_d$              | 0.587 56  | 1.734 00 |
| $n_e$              | 0.546 07  | 1.737 39 |
| $n_F$              | 0.486 13  | 1.743 94 |
| $n_{F'}$           | 0.479 99  | 1.744 76 |
| $n_{He-Cd}$        | 0.441 57  | 1.750 72 |
| $n_g$              | 0.435 835 | 1.751 76 |
| $n_h$              | 0.404 656 | 1.758 29 |
| $n_i$              | 0.365 015 | 1.769 50 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.139 627 42E+00 |
| $A_2$                           | 8.052 278 38E-01 |
| $A_3$                           | 1.294 880 61E+00 |
| $B_1$                           | 4.932 948 62E-03 |
| $B_2$                           | 2.024 799 60E-02 |
| $B_3$                           | 9.347 465 07E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 52.0 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 113.7 |
| Rigidity Modulus G (GPa) | 44.0  |
| Poisson's Ratio $\sigma$ | 0.293 |
| Knoop Hardness Hk[Class] | 680 7 |
| Abrasion Aa              | 69    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 504 |
| $n_C - n_{A'}$      | 0.004 905 |
| $n_d - n_C$         | 0.004 318 |
| $n_e - n_C$         | 0.007 716 |
| $n_g - n_d$         | 0.017 767 |
| $n_g - n_F$         | 0.007 824 |
| $n_h - n_g$         | 0.006 531 |
| $n_i - n_g$         | 0.017 734 |
| $n_{C'} - n_t$      | 0.012 190 |
| $n_e - n_{C'}$      | 0.007 030 |
| $n_{F'} - n_e$      | 0.007 362 |
| $n_i - n_{F'}$      | 0.024 741 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.806 7 |
| $\theta_{C,A'}$              | 0.343 9 |
| $\theta_{d,C}$               | 0.302 8 |
| $\theta_{e,C}$               | 0.541 1 |
| $\theta_{g,d}$               | 1.245 8 |
| $\theta_{g,F}$               | 0.548 6 |
| $\theta_{h,g}$               | 0.458 0 |
| $\theta_{i,g}$               | 1.243 5 |
| $\theta'_{C,t}$              | 0.847 0 |
| $\theta'_{e,C'}$             | 0.488 5 |
| $\theta'_{F',e}$             | 0.511 5 |
| $\theta'_{i,F'}$             | 1.719 1 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.018 5  |
| $\Delta\theta_{C,A'}$ | 0.005 6  |
| $\Delta\theta_{g,d}$  | -0.012 0 |
| $\Delta\theta_{g,F}$  | -0.009 6 |
| $\Delta\theta_{i,g}$  | -0.050 5 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 365  | $\lambda_5$      | 280 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 347  | $\lambda_{0.05}$ | 283 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.36 | 0.33             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    | 0.02             |
| 290                    | 0.11             |
| 300                    | 0.20             |
| 310                    | 0.34             |
| 320                    | 0.48             |
| 330                    | 0.62             |
| 340                    | 0.74             |
| 350                    | 0.83             |
| 360                    | 0.89             |
| 370                    | 0.934            |
| 380                    | 0.959            |
| 390                    | 0.973            |
| 400                    | 0.982            |
| 420                    | 0.990            |
| 440                    | 0.993            |
| 460                    | 0.995            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.994            |
| 1 600                  | 0.994            |
| 1 800                  | 0.986            |
| 2 000                  | 0.964            |
| 2 200                  | 0.905            |
| 2 400                  | 0.65             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 591   |
| Annealing Point AP (°C)                                          | 620   |
| Transformation Temperature Tg (°C)                               | 641   |
| Yield Point At (°C)                                              | 675   |
| Softening Point SP (°C)                                          | 696   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 55    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 69    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.863 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 42                                             |
| -90 ~ -80                               | 43                                             |
| -80 ~ -70                               | 45                                             |
| -70 ~ -60                               | 46                                             |
| -60 ~ -50                               | 47                                             |
| -50 ~ -40                               | 48                                             |
| -40 ~ -30                               | 49                                             |
| -30 ~ -20                               | 50                                             |
| -20 ~ -10                               | 51                                             |
| -10 ~ 0                                 | 52                                             |
| 0 ~ 10                                  | 53                                             |
| 10 ~ 20                                 | 54                                             |
| 20 ~ 30                                 | 55                                             |
| 30 ~ 40                                 | 56                                             |
| 40 ~ 50                                 | 57                                             |
| 50 ~ 60                                 | 58                                             |
| 60 ~ 70                                 | 59                                             |
| 70 ~ 80                                 | 60                                             |
| 80 ~ 90                                 | 61                                             |
| 90 ~ 100                                | 62                                             |
| 100 ~ 110                               | 63                                             |
| 110 ~ 120                               | 63                                             |
| 120 ~ 130                               | 64                                             |
| 130 ~ 140                               | 65                                             |
| 140 ~ 150                               | 66                                             |
| 150 ~ 160                               | 67                                             |
| 160 ~ 170                               | 67                                             |
| 170 ~ 180                               | 68                                             |
| 180 ~ 190                               | 69                                             |
| 190 ~ 200                               | 69                                             |
| 200 ~ 210                               | 70                                             |
| 210 ~ 220                               | 70                                             |
| 220 ~ 230                               | 71                                             |
| 230 ~ 240                               | 72                                             |
| 240 ~ 250                               | 72                                             |
| 250 ~ 260                               | 73                                             |
| 260 ~ 270                               | 73                                             |
| 270 ~ 280                               | 74                                             |
| 280 ~ 290                               | 74                                             |
| 290 ~ 300                               | 74                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.87 |
| Specific Gravity $d$                                     | 4.04 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 4.3                                                             | 4.4 | 4.7 | 4.8 | 5.0 | 5.1 | 5.2 | 5.6 | 5.6 | 6.0 | 6.4 | 7.1 |
| -60 ~ -40                                    | 4.1                                                             | 4.3 | 4.7 | 4.8 | 4.8 | 5.0 | 5.1 | 5.4 | 5.5 | 6.0 | 6.3 | 7.1 |
| -40 ~ -20                                    | 4.1                                                             | 4.3 | 4.6 | 4.7 | 4.7 | 5.0 | 5.2 | 5.5 | 5.5 | 5.9 | 6.3 | 7.2 |
| -20 ~ 0                                      | 4.2                                                             | 4.3 | 4.7 | 4.8 | 4.8 | 5.0 | 5.2 | 5.5 | 5.6 | 6.1 | 6.5 | 7.3 |
| 0 ~ 20                                       | 4.2                                                             | 4.4 | 4.7 | 4.9 | 4.9 | 5.1 | 5.3 | 5.7 | 5.8 | 6.2 | 6.6 | 7.5 |
| 20 ~ 40                                      | 4.3                                                             | 4.5 | 4.9 | 5.0 | 5.0 | 5.2 | 5.4 | 5.8 | 5.8 | 6.4 | 6.9 | 7.7 |
| 40 ~ 60                                      | 4.4                                                             | 4.6 | 5.0 | 5.1 | 5.2 | 5.4 | 5.5 | 6.0 | 6.1 | 6.6 | 7.0 | 8.0 |
| 60 ~ 80                                      | 4.5                                                             | 4.8 | 5.2 | 5.3 | 5.4 | 5.6 | 5.7 | 6.2 | 6.2 | 6.7 | 7.2 | 8.2 |
| 80 ~ 100                                     | 4.6                                                             | 4.8 | 5.2 | 5.4 | 5.5 | 5.7 | 5.9 | 6.4 | 6.4 | 6.9 | 7.4 | 8.4 |
| 100 ~ 120                                    | 4.7                                                             | 5.0 | 5.4 | 5.5 | 5.6 | 5.8 | 6.1 | 6.6 | 6.6 | 7.1 | 7.7 | 8.7 |
| 120 ~ 140                                    | 4.8                                                             | 5.0 | 5.6 | 5.6 | 5.7 | 6.0 | 6.1 | 6.7 | 6.7 | 7.3 | 7.8 | 8.9 |
| 140 ~ 160                                    | 5.0                                                             | 5.2 | 5.7 | 5.8 | 5.9 | 6.1 | 6.3 | 6.8 | 6.9 | 7.4 | 8.0 | 9.1 |
| 160 ~ 180                                    | 5.0                                                             | 5.3 | 5.7 | 5.9 | 5.9 | 6.2 | 6.4 | 6.9 | 7.0 | 7.5 | 8.1 | 9.2 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.741 00<br>1.740 999 | Abbe Number $\nu_d$ | 52.64 | Dispersion $n_F - n_C$       | 0.014 078 |
| Refractive Index $n_e$ | 1.744 354             | Abbe Number $\nu_e$ | 52.41 | Dispersion $n_{F'} - n_{C'}$ | 0.014 203 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.700 16 |
| $n_{1970}$         | 1.970 09  | 1.707 87 |
| $n_{1530}$         | 1.529 58  | 1.715 98 |
| $n_{1129}$         | 1.128 64  | 1.722 97 |
| $n_t$              | 1.013 98  | 1.725 25 |
| $n_s$              | 0.852 11  | 1.729 18 |
| $n_{A'}$           | 0.768 19  | 1.731 86 |
| $n_F$              | 0.706 52  | 1.734 30 |
| $n_C$              | 0.656 27  | 1.736 73 |
| $n_{C'}$           | 0.643 85  | 1.737 41 |
| $n_{He-Ne}$        | 0.632 8   | 1.738 04 |
| $n_D$              | 0.589 29  | 1.740 87 |
| $n_d$              | 0.587 56  | 1.741 00 |
| $n_e$              | 0.546 07  | 1.744 35 |
| $n_F$              | 0.486 13  | 1.750 80 |
| $n_{F'}$           | 0.479 99  | 1.751 61 |
| $n_{He-Cd}$        | 0.441 57  | 1.757 48 |
| $n_g$              | 0.435 835 | 1.758 50 |
| $n_h$              | 0.404 656 | 1.764 91 |
| $n_i$              | 0.365 015 | 1.775 89 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.110 732 92E+00 |
| $A_2$                           | 8.593 477 73E-01 |
| $A_3$                           | 1.267 074 33E+00 |
| $B_1$                           | 4.641 812 48E-03 |
| $B_2$                           | 1.929 892 61E-02 |
| $B_3$                           | 8.739 176 98E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 1~2  |
| Acid Resistance(Surface) Group SR         | 51.0 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 119.0 |
| Rigidity Modulus G (GPa) | 46.1  |
| Poisson's Ratio $\sigma$ | 0.291 |
| Knoop Hardness Hk[Class] | 720 7 |
| Abrasion Aa              | 71    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 481 |
| $n_C - n_{A'}$      | 0.004 871 |
| $n_d - n_C$         | 0.004 272 |
| $n_e - n_C$         | 0.007 627 |
| $n_g - n_d$         | 0.017 502 |
| $n_g - n_F$         | 0.007 696 |
| $n_h - n_g$         | 0.006 413 |
| $n_i - n_g$         | 0.017 393 |
| $n_{C'} - n_t$      | 0.012 160 |
| $n_e - n_{C'}$      | 0.006 948 |
| $n_{F'} - n_e$      | 0.007 255 |
| $n_i - n_{F'}$      | 0.024 285 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.815 5 |
| $\theta_{C,A'}$              | 0.346 0 |
| $\theta_{d,C}$               | 0.303 5 |
| $\theta_{e,C}$               | 0.541 8 |
| $\theta_{g,d}$               | 1.243 2 |
| $\theta_{g,F}$               | 0.546 7 |
| $\theta_{h,g}$               | 0.455 5 |
| $\theta_{i,g}$               | 1.235 5 |
| $\theta'_{C,t}$              | 0.856 2 |
| $\theta'_{e,C'}$             | 0.489 2 |
| $\theta'_{F',e}$             | 0.510 8 |
| $\theta'_{i,F'}$             | 1.709 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.021 8  |
| $\Delta\theta_{C,A'}$ | 0.006 3  |
| $\Delta\theta_{g,d}$  | -0.012 2 |
| $\Delta\theta_{g,F}$  | -0.009 6 |
| $\Delta\theta_{i,g}$  | -0.048 7 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 365  | $\lambda_5$      | 280 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 358  | $\lambda_{0.05}$ | 296 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.58 | 0.59             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    | 0.02             |
| 300                    | 0.07             |
| 310                    | 0.15             |
| 320                    | 0.27             |
| 330                    | 0.43             |
| 340                    | 0.59             |
| 350                    | 0.72             |
| 360                    | 0.82             |
| 370                    | 0.89             |
| 380                    | 0.935            |
| 390                    | 0.958            |
| 400                    | 0.971            |
| 420                    | 0.982            |
| 440                    | 0.988            |
| 460                    | 0.991            |
| 480                    | 0.994            |
| 500                    | 0.996            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.994            |
| 1 600                  | 0.994            |
| 1 800                  | 0.985            |
| 2 000                  | 0.959            |
| 2 200                  | 0.88             |
| 2 400                  | 0.62             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 631   |
| Annealing Point AP (°C)                                          | 646   |
| Transformation Temperature Tg (°C)                               | 668   |
| Yield Point At (°C)                                              | 690   |
| Softening Point SP (°C)                                          | 724   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 58    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 72    |
| Thermal Conductivity $\lambda$ (W/(mK))                          | 0.861 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 45                                             |
| -90 ~ -80                               | 47                                             |
| -80 ~ -70                               | 48                                             |
| -70 ~ -60                               | 49                                             |
| -60 ~ -50                               | 50                                             |
| -50 ~ -40                               | 51                                             |
| -40 ~ -30                               | 52                                             |
| -30 ~ -20                               | 53                                             |
| -20 ~ -10                               | 54                                             |
| -10 ~ 0                                 | 56                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 59                                             |
| 40 ~ 50                                 | 60                                             |
| 50 ~ 60                                 | 61                                             |
| 60 ~ 70                                 | 62                                             |
| 70 ~ 80                                 | 63                                             |
| 80 ~ 90                                 | 64                                             |
| 90 ~ 100                                | 65                                             |
| 100 ~ 110                               | 66                                             |
| 110 ~ 120                               | 66                                             |
| 120 ~ 130                               | 67                                             |
| 130 ~ 140                               | 68                                             |
| 140 ~ 150                               | 69                                             |
| 150 ~ 160                               | 69                                             |
| 160 ~ 170                               | 70                                             |
| 170 ~ 180                               | 71                                             |
| 180 ~ 190                               | 71                                             |
| 190 ~ 200                               | 72                                             |
| 200 ~ 210                               | 72                                             |
| 210 ~ 220                               | 73                                             |
| 220 ~ 230                               | 74                                             |
| 230 ~ 240                               | 74                                             |
| 240 ~ 250                               | 75                                             |
| 250 ~ 260                               | 75                                             |
| 260 ~ 270                               | 76                                             |
| 270 ~ 280                               | 76                                             |
| 280 ~ 290                               | 76                                             |
| 290 ~ 300                               | 77                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.55 |
| Specific Gravity $d$                                     | 4.04 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.6                                                             | 2.7 | 3.1 | 3.2 | 3.2 | 3.3 | 3.5 | 3.7 | 3.8 | 4.2 | 4.5 | 5.2 |
| -60 ~ -40                                    | 2.5                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.2 | 3.4 | 3.7 | 3.7 | 4.1 | 4.5 | 5.1 |
| -40 ~ -20                                    | 2.5                                                             | 2.7 | 2.9 | 3.0 | 3.1 | 3.3 | 3.4 | 3.7 | 3.8 | 4.1 | 4.5 | 5.2 |
| -20 ~ 0                                      | 2.6                                                             | 2.8 | 3.1 | 3.2 | 3.2 | 3.3 | 3.5 | 3.9 | 3.9 | 4.3 | 4.7 | 5.3 |
| 0 ~ 20                                       | 2.7                                                             | 2.8 | 3.2 | 3.3 | 3.3 | 3.4 | 3.6 | 4.0 | 4.1 | 4.4 | 4.8 | 5.5 |
| 20 ~ 40                                      | 2.8                                                             | 3.0 | 3.3 | 3.4 | 3.4 | 3.6 | 3.8 | 4.1 | 4.1 | 4.5 | 5.0 | 5.7 |
| 40 ~ 60                                      | 2.9                                                             | 3.1 | 3.4 | 3.5 | 3.6 | 3.7 | 3.9 | 4.3 | 4.4 | 4.8 | 5.2 | 5.9 |
| 60 ~ 80                                      | 3.0                                                             | 3.3 | 3.6 | 3.7 | 3.7 | 3.9 | 4.1 | 4.4 | 4.5 | 4.9 | 5.3 | 6.1 |
| 80 ~ 100                                     | 3.1                                                             | 3.3 | 3.7 | 3.9 | 3.9 | 4.1 | 4.2 | 4.6 | 4.7 | 5.1 | 5.5 | 6.3 |
| 100 ~ 120                                    | 3.2                                                             | 3.4 | 3.7 | 3.9 | 3.9 | 4.1 | 4.4 | 4.7 | 4.8 | 5.2 | 5.6 | 6.4 |
| 120 ~ 140                                    | 3.3                                                             | 3.5 | 3.9 | 4.0 | 4.1 | 4.3 | 4.4 | 4.8 | 4.9 | 5.3 | 5.8 | 6.6 |
| 140 ~ 160                                    | 3.4                                                             | 3.6 | 4.0 | 4.1 | 4.1 | 4.3 | 4.5 | 4.9 | 4.9 | 5.4 | 5.8 | 6.7 |
| 160 ~ 180                                    | 3.4                                                             | 3.6 | 3.9 | 4.1 | 4.1 | 4.3 | 4.5 | 4.9 | 4.9 | 5.4 | 5.9 | 6.7 |

## S-LAL61Q

Code(d) 741526

Code(e) 744523

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.741 00<br>1.741 000 | Abbe Number $\nu_d$ | 52.60 | Dispersion $n_F - n_C$       | 0.014 087 |
| Refractive Index $n_e$ | 1.744 357             | Abbe Number $\nu_e$ | 52.36 | Dispersion $n_{F'} - n_{C'}$ | 0.014 216 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.702 06 |
| $n_{1970}$         | 1.970 09  | 1.709 13 |
| $n_{1530}$         | 1.529 58  | 1.716 62 |
| $n_{1129}$         | 1.128 64  | 1.723 22 |
| $n_t$              | 1.013 98  | 1.725 41 |
| $n_s$              | 0.852 11  | 1.729 25 |
| $n_{A'}$           | 0.768 19  | 1.731 89 |
| $n_F$              | 0.706 52  | 1.734 31 |
| $n_C$              | 0.656 27  | 1.736 73 |
| $n_{C'}$           | 0.643 85  | 1.737 41 |
| $n_{He-Ne}$        | 0.632 8   | 1.738 04 |
| $n_D$              | 0.589 29  | 1.740 87 |
| $n_d$              | 0.587 56  | 1.741 00 |
| $n_e$              | 0.546 07  | 1.744 36 |
| $n_F$              | 0.486 13  | 1.750 82 |
| $n_{F'}$           | 0.479 99  | 1.751 63 |
| $n_{He-Cd}$        | 0.441 57  | 1.757 51 |
| $n_g$              | 0.435 835 | 1.758 54 |
| $n_h$              | 0.404 656 | 1.764 97 |
| $n_i$              | 0.365 015 | 1.775 98 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.381 442 25E+00 |
| $A_2$                           | 5.876 900 89E-01 |
| $A_3$                           | 1.152 454 65E+00 |
| $B_1$                           | 6.691 926 52E-03 |
| $B_2$                           | 2.159 812 33E-02 |
| $B_3$                           | 8.719 233 00E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 51.0 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 116.5 |
| Rigidity Modulus G (GPa) | 45.1  |
| Poisson's Ratio $\sigma$ | 0.292 |
| Knoop Hardness Hk[Class] | 710 7 |
| Abrasion Aa              | 66    |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 323 |
| $n_C - n_{A'}$      | 0.004 841 |
| $n_d - n_C$         | 0.004 267 |
| $n_e - n_C$         | 0.007 624 |
| $n_g - n_d$         | 0.017 538 |
| $n_g - n_F$         | 0.007 718 |
| $n_h - n_g$         | 0.006 432 |
| $n_i - n_g$         | 0.017 446 |
| $n_{C'} - n_t$      | 0.012 001 |
| $n_e - n_{C'}$      | 0.006 946 |
| $n_{F'} - n_e$      | 0.007 270 |
| $n_i - n_{F'}$      | 0.024 357 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.803 8 |
| $\theta_{C,A'}$              | 0.343 7 |
| $\theta_{d,C}$               | 0.302 9 |
| $\theta_{e,C}$               | 0.541 2 |
| $\theta_{g,d}$               | 1.245 0 |
| $\theta_{g,F}$               | 0.547 9 |
| $\theta_{h,g}$               | 0.456 6 |
| $\theta_{i,g}$               | 1.238 4 |
| $\theta'_{C,t}$              | 0.844 2 |
| $\theta'_{e,C'}$             | 0.488 6 |
| $\theta'_{F',e}$             | 0.511 4 |
| $\theta'_{i,F'}$             | 1.713 4 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.010 3  |
| $\Delta\theta_{C,A'}$ | 0.004 1  |
| $\Delta\theta_{g,d}$  | -0.010 5 |
| $\Delta\theta_{g,F}$  | -0.008 5 |
| $\Delta\theta_{i,g}$  | -0.046 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 360  | $\lambda_5$      | 300 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 337  | $\lambda_{0.05}$ | 298 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.26 | 0.26             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    | 0.06             |
| 310                    | 0.26             |
| 320                    | 0.52             |
| 330                    | 0.72             |
| 340                    | 0.83             |
| 350                    | 0.902            |
| 360                    | 0.940            |
| 370                    | 0.962            |
| 380                    | 0.975            |
| 390                    | 0.983            |
| 400                    | 0.988            |
| 420                    | 0.992            |
| 440                    | 0.994            |
| 460                    | 0.996            |
| 480                    | 0.998            |
| 500                    | 0.999            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.995            |
| 1 600                  | 0.995            |
| 1 800                  | 0.986            |
| 2 000                  | 0.962            |
| 2 200                  | 0.89             |
| 2 400                  | 0.66             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 644   |
| Annealing Point AP (°C)                                          | 670   |
| Transformation Temperature Tg (°C)                               | 687   |
| Yield Point At (°C)                                              | 713   |
| Softening Point SP (°C)                                          | 737   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 61    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 74    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.850 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 48                                             |
| -90 ~ -80                               | 49                                             |
| -80 ~ -70                               | 50                                             |
| -70 ~ -60                               | 52                                             |
| -60 ~ -50                               | 53                                             |
| -50 ~ -40                               | 54                                             |
| -40 ~ -30                               | 55                                             |
| -30 ~ -20                               | 56                                             |
| -20 ~ -10                               | 57                                             |
| -10 ~ 0                                 | 58                                             |
| 0 ~ 10                                  | 59                                             |
| 10 ~ 20                                 | 60                                             |
| 20 ~ 30                                 | 61                                             |
| 30 ~ 40                                 | 62                                             |
| 40 ~ 50                                 | 63                                             |
| 50 ~ 60                                 | 64                                             |
| 60 ~ 70                                 | 65                                             |
| 70 ~ 80                                 | 66                                             |
| 80 ~ 90                                 | 67                                             |
| 90 ~ 100                                | 68                                             |
| 100 ~ 110                               | 68                                             |
| 110 ~ 120                               | 69                                             |
| 120 ~ 130                               | 70                                             |
| 130 ~ 140                               | 71                                             |
| 140 ~ 150                               | 71                                             |
| 150 ~ 160                               | 72                                             |
| 160 ~ 170                               | 73                                             |
| 170 ~ 180                               | 73                                             |
| 180 ~ 190                               | 74                                             |
| 190 ~ 200                               | 75                                             |
| 200 ~ 210                               | 75                                             |
| 210 ~ 220                               | 76                                             |
| 220 ~ 230                               | 76                                             |
| 230 ~ 240                               | 77                                             |
| 240 ~ 250                               | 77                                             |
| 250 ~ 260                               | 78                                             |
| 260 ~ 270                               | 78                                             |
| 270 ~ 280                               | 78                                             |
| 280 ~ 290                               | 79                                             |
| 290 ~ 300                               | 79                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.47 |
| Specific Gravity $d$                                     | 4.09 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.8                                                             | 2.9 | 3.2 | 3.3 | 3.3 | 3.5 | 3.6 | 3.9 | 4.0 | 4.4 | 4.8 | 5.7 |
| -60 ~ -40                                    | 2.7                                                             | 2.8 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.8 | 3.9 | 4.3 | 4.7 | 5.5 |
| -40 ~ -20                                    | 2.7                                                             | 2.8 | 3.1 | 3.2 | 3.3 | 3.4 | 3.6 | 3.9 | 3.9 | 4.3 | 4.7 | 5.6 |
| -20 ~ 0                                      | 2.8                                                             | 2.9 | 3.2 | 3.3 | 3.3 | 3.5 | 3.6 | 3.9 | 4.0 | 4.5 | 4.9 | 5.7 |
| 0 ~ 20                                       | 2.9                                                             | 3.0 | 3.3 | 3.4 | 3.4 | 3.6 | 3.7 | 4.1 | 4.2 | 4.6 | 5.0 | 5.8 |
| 20 ~ 40                                      | 3.0                                                             | 3.1 | 3.4 | 3.5 | 3.5 | 3.7 | 3.8 | 4.2 | 4.2 | 4.7 | 5.1 | 6.0 |
| 40 ~ 60                                      | 3.1                                                             | 3.2 | 3.5 | 3.6 | 3.6 | 3.8 | 4.0 | 4.4 | 4.4 | 4.8 | 5.3 | 6.1 |
| 60 ~ 80                                      | 3.2                                                             | 3.4 | 3.7 | 3.8 | 3.8 | 4.0 | 4.1 | 4.4 | 4.5 | 4.9 | 5.3 | 6.2 |
| 80 ~ 100                                     | 3.2                                                             | 3.4 | 3.7 | 3.9 | 3.9 | 4.1 | 4.2 | 4.6 | 4.6 | 5.0 | 5.5 | 6.4 |
| 100 ~ 120                                    | 3.3                                                             | 3.5 | 3.8 | 3.9 | 3.9 | 4.1 | 4.3 | 4.7 | 4.7 | 5.1 | 5.6 | 6.5 |
| 120 ~ 140                                    | 3.3                                                             | 3.5 | 3.9 | 4.0 | 4.0 | 4.2 | 4.4 | 4.7 | 4.8 | 5.2 | 5.6 | 6.5 |
| 140 ~ 160                                    | 3.4                                                             | 3.6 | 3.9 | 4.0 | 4.0 | 4.2 | 4.4 | 4.7 | 4.8 | 5.2 | 5.6 | 6.6 |
| 160 ~ 180                                    | 3.4                                                             | 3.5 | 3.8 | 3.9 | 4.0 | 4.1 | 4.3 | 4.7 | 4.7 | 5.1 | 5.6 | 6.5 |

## S-LAM 2

Code(d) 744448

Code(e) 748445

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.744 00<br>1.743 997 | Abbe Number $\nu_d$ | 44.78 | Dispersion $n_F - n_C$       | 0.016 613 |
| Refractive Index $n_e$ | 1.747 946             | Abbe Number $\nu_e$ | 44.50 | Dispersion $n_{F'} - n_{C'}$ | 0.016 806 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.705 97 |
| $n_{1970}$         | 1.970 09  | 1.711 77 |
| $n_{1530}$         | 1.529 58  | 1.718 20 |
| $n_{1129}$         | 1.128 64  | 1.724 36 |
| $n_t$              | 1.013 98  | 1.726 58 |
| $n_s$              | 0.852 11  | 1.730 65 |
| $n_{A'}$           | 0.768 19  | 1.733 56 |
| $n_F$              | 0.706 52  | 1.736 29 |
| $n_C$              | 0.656 27  | 1.739 05 |
| $n_{C'}$           | 0.643 85  | 1.739 83 |
| $n_{He-Ne}$        | 0.632 8   | 1.740 56 |
| $n_D$              | 0.589 29  | 1.743 85 |
| $n_d$              | 0.587 56  | 1.744 00 |
| $n_e$              | 0.546 07  | 1.747 95 |
| $n_F$              | 0.486 13  | 1.755 66 |
| $n_{F'}$           | 0.479 99  | 1.756 63 |
| $n_{He-Cd}$        | 0.441 57  | 1.763 80 |
| $n_g$              | 0.435 835 | 1.765 06 |
| $n_h$              | 0.404 656 | 1.773 04 |
| $n_i$              | 0.365 015 | 1.787 08 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.771 300 00E+00 |
| $A_2$                           | 1.958 142 30E-01 |
| $A_3$                           | 1.194 878 34E+00 |
| $B_1$                           | 9.766 524 44E-03 |
| $B_2$                           | 4.127 186 28E-02 |
| $B_3$                           | 1.104 581 22E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2~3  |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 3.0  |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 93.5    |
| Rigidity Modulus G (GPa) | 36.1    |
| Poisson's Ratio $\sigma$ | 0.295   |
| Knoop Hardness Hk[Class] | 570   6 |
| Abrasion Aa              | 157     |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.012 472 |
| $n_C - n_{A'}$      | 0.005 488 |
| $n_d - n_C$         | 0.004 949 |
| $n_e - n_C$         | 0.008 898 |
| $n_g - n_d$         | 0.021 058 |
| $n_g - n_F$         | 0.009 394 |
| $n_h - n_g$         | 0.007 986 |
| $n_i - n_g$         | 0.022 027 |
| $n_{C'} - n_t$      | 0.013 252 |
| $n_e - n_{C'}$      | 0.008 118 |
| $n_{F'} - n_e$      | 0.008 688 |
| $n_i - n_{F'}$      | 0.030 448 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.750 7 |
| $\theta_{C,A'}$              | 0.330 3 |
| $\theta_{d,C}$               | 0.297 9 |
| $\theta_{e,C}$               | 0.535 6 |
| $\theta_{g,d}$               | 1.267 6 |
| $\theta_{g,F}$               | 0.565 5 |
| $\theta_{h,g}$               | 0.480 7 |
| $\theta_{i,g}$               | 1.325 9 |
| $\theta'_{C,t}$              | 0.788 5 |
| $\theta'_{e,C'}$             | 0.483 0 |
| $\theta'_{F,e}$              | 0.517 0 |
| $\theta'_{i,F'}$             | 1.811 7 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.006 1 |
| $\Delta\theta_{C,A'}$ | 0.000 2  |
| $\Delta\theta_{g,d}$  | -0.004 1 |
| $\Delta\theta_{g,F}$  | -0.003 5 |
| $\Delta\theta_{i,g}$  | -0.024 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 395  | $\lambda_5$      | 340 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 372  | $\lambda_{0.05}$ | 340 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.00 | 1.02             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.04             |
| 350                    | 0.29             |
| 360                    | 0.59             |
| 370                    | 0.78             |
| 380                    | 0.87             |
| 390                    | 0.925            |
| 400                    | 0.950            |
| 420                    | 0.973            |
| 440                    | 0.983            |
| 460                    | 0.987            |
| 480                    | 0.992            |
| 500                    | 0.995            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.988            |
| 2 000                  | 0.971            |
| 2 200                  | 0.928            |
| 2 400                  | 0.79             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 590   |
| Annealing Point AP (°C)                                          | 617   |
| Transformation Temperature Tg (°C)                               | 631   |
| Yield Point At (°C)                                              | 677   |
| Softening Point SP (°C)                                          | 711   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 75    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 88    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.698 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 63                                             |
| -90 ~ -80                               | 64                                             |
| -80 ~ -70                               | 65                                             |
| -70 ~ -60                               | 66                                             |
| -60 ~ -50                               | 67                                             |
| -50 ~ -40                               | 68                                             |
| -40 ~ -30                               | 70                                             |
| -30 ~ -20                               | 71                                             |
| -20 ~ -10                               | 72                                             |
| -10 ~ 0                                 | 73                                             |
| 0 ~ 10                                  | 74                                             |
| 10 ~ 20                                 | 75                                             |
| 20 ~ 30                                 | 75                                             |
| 30 ~ 40                                 | 76                                             |
| 40 ~ 50                                 | 77                                             |
| 50 ~ 60                                 | 78                                             |
| 60 ~ 70                                 | 79                                             |
| 70 ~ 80                                 | 80                                             |
| 80 ~ 90                                 | 81                                             |
| 90 ~ 100                                | 82                                             |
| 100 ~ 110                               | 82                                             |
| 110 ~ 120                               | 83                                             |
| 120 ~ 130                               | 84                                             |
| 130 ~ 140                               | 85                                             |
| 140 ~ 150                               | 85                                             |
| 150 ~ 160                               | 86                                             |
| 160 ~ 170                               | 87                                             |
| 170 ~ 180                               | 87                                             |
| 180 ~ 190                               | 88                                             |
| 190 ~ 200                               | 88                                             |
| 200 ~ 210                               | 89                                             |
| 210 ~ 220                               | 90                                             |
| 220 ~ 230                               | 90                                             |
| 230 ~ 240                               | 91                                             |
| 240 ~ 250                               | 91                                             |
| 250 ~ 260                               | 92                                             |
| 260 ~ 270                               | 92                                             |
| 270 ~ 280                               | 93                                             |
| 280 ~ 290                               | 93                                             |
| 290 ~ 300                               | 93                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.72 |
| Specific Gravity $d$                                      | 4.32 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.4                                                             | 1.6 | 2.0 | 2.1 | 2.2 | 2.4 | 2.5 | 3.0 | 3.0 | 3.6 | 4.1 | 5.3 |
| -60 ~ -40                                    | 1.2                                                             | 1.5 | 1.8 | 2.0 | 2.0 | 2.2 | 2.4 | 2.8 | 3.0 | 3.5 | 4.1 | 5.3 |
| -40 ~ -20                                    | 1.2                                                             | 1.3 | 1.7 | 1.9 | 2.0 | 2.2 | 2.4 | 2.9 | 2.9 | 3.5 | 4.2 | 5.3 |
| -20 ~ 0                                      | 1.2                                                             | 1.4 | 1.8 | 1.9 | 2.0 | 2.2 | 2.4 | 3.0 | 3.1 | 3.6 | 4.3 | 5.5 |
| 0 ~ 20                                       | 1.2                                                             | 1.4 | 1.8 | 2.0 | 2.0 | 2.3 | 2.5 | 3.1 | 3.2 | 3.8 | 4.4 | 5.7 |
| 20 ~ 40                                      | 1.3                                                             | 1.5 | 2.0 | 2.1 | 2.2 | 2.4 | 2.6 | 3.2 | 3.2 | 4.0 | 4.6 | 6.0 |
| 40 ~ 60                                      | 1.4                                                             | 1.6 | 2.1 | 2.2 | 2.3 | 2.5 | 2.8 | 3.4 | 3.5 | 4.1 | 4.8 | 6.2 |
| 60 ~ 80                                      | 1.5                                                             | 1.8 | 2.2 | 2.4 | 2.4 | 2.7 | 3.0 | 3.5 | 3.6 | 4.3 | 5.0 | 6.5 |
| 80 ~ 100                                     | 1.5                                                             | 1.8 | 2.4 | 2.6 | 2.6 | 2.9 | 3.1 | 3.7 | 3.8 | 4.5 | 5.3 | 6.7 |
| 100 ~ 120                                    | 1.6                                                             | 1.9 | 2.4 | 2.6 | 2.6 | 3.0 | 3.3 | 3.9 | 4.0 | 4.7 | 5.5 | 7.0 |
| 120 ~ 140                                    | 1.7                                                             | 2.0 | 2.6 | 2.8 | 2.8 | 3.1 | 3.4 | 4.0 | 4.1 | 4.9 | 5.7 | 7.3 |
| 140 ~ 160                                    | 1.8                                                             | 2.1 | 2.7 | 2.9 | 2.9 | 3.2 | 3.5 | 4.2 | 4.2 | 5.0 | 5.8 | 7.5 |
| 160 ~ 180                                    | 1.9                                                             | 2.2 | 2.7 | 2.9 | 3.0 | 3.3 | 3.6 | 4.3 | 4.4 | 5.2 | 6.0 | 7.7 |

OHARA 25-04

S-LAM 3

Code(d) 717479  
Code(e) 721476

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.717 00<br>1.717 004 | Abbe Number $\nu_d$ | 47.92 | Dispersion $n_F - n_C$       | 0.014 961 |
| Refractive Index $n_e$ | 1.720 563             | Abbe Number $\nu_e$ | 47.64 | Dispersion $n_{F'} - n_{C'}$ | 0.015 124 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.681 33 |
| $n_{1970}$         | 1.970 09  | 1.686 99 |
| $n_{1530}$         | 1.529 58  | 1.693 20 |
| $n_{1129}$         | 1.128 64  | 1.699 05 |
| $n_t$              | 1.013 98  | 1.701 11 |
| $n_s$              | 0.852 11  | 1.704 88 |
| $n_{A'}$           | 0.768 19  | 1.707 54 |
| $n_F$              | 0.706 52  | 1.710 02 |
| $n_C$              | 0.656 27  | 1.712 53 |
| $n_{C'}$           | 0.643 85  | 1.713 23 |
| $n_{He-Ne}$        | 0.632 8   | 1.713 90 |
| $n_D$              | 0.589 29  | 1.716 87 |
| $n_d$              | 0.587 56  | 1.717 00 |
| $n_e$              | 0.546 07  | 1.720 56 |
| $n_F$              | 0.486 13  | 1.727 49 |
| $n_{F'}$           | 0.479 99  | 1.728 36 |
| $n_{He-Cd}$        | 0.441 57  | 1.734 75 |
| $n_g$              | 0.435 835 | 1.735 87 |
| $n_h$              | 0.404 656 | 1.742 96 |
| $n_i$              | 0.365 015 | 1.755 31 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.642 587 13E+00 |
| $A_2$                           | 2.396 346 10E-01 |
| $A_3$                           | 1.224 830 26E+00 |
| $B_1$                           | 8.682 460 20E-03 |
| $B_2$                           | 3.512 262 42E-02 |
| $B_3$                           | 1.166 043 69E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 53.2 |
| Phosphate Resistance PR                   | 4.2  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 86.8  |
| Rigidity Modulus G (GPa) | 33.5  |
| Poisson's Ratio $\sigma$ | 0.294 |
| Knoop Hardness Hk[Class] | 530 5 |
| Abrasion Aa              | 184   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 413 |
| $n_C - n_{A'}$      | 0.004 990 |
| $n_d - n_C$         | 0.004 476 |
| $n_e - n_C$         | 0.008 035 |
| $n_g - n_d$         | 0.018 871 |
| $n_g - n_F$         | 0.008 386 |
| $n_h - n_g$         | 0.007 085 |
| $n_i - n_g$         | 0.019 433 |
| $n_{C'} - n_t$      | 0.012 120 |
| $n_e - n_{C'}$      | 0.007 328 |
| $n_{F'} - n_e$      | 0.007 796 |
| $n_i - n_{F'}$      | 0.026 949 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.762 9 |
| $\theta_{C,A'}$              | 0.333 5 |
| $\theta_{d,C}$               | 0.299 2 |
| $\theta_{e,C}$               | 0.537 1 |
| $\theta_{g,d}$               | 1.261 3 |
| $\theta_{g,F}$               | 0.560 5 |
| $\theta_{h,g}$               | 0.473 6 |
| $\theta_{i,g}$               | 1.298 9 |
| $\theta'_{C,t}$              | 0.801 4 |
| $\theta'_{e,C'}$             | 0.484 5 |
| $\theta'_{F',e}$             | 0.515 5 |
| $\theta'_{i,F'}$             | 1.781 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.008 6 |
| $\Delta\theta_{C,A'}$ | -0.000 4 |
| $\Delta\theta_{g,d}$  | -0.003 9 |
| $\Delta\theta_{g,F}$  | -0.003 4 |
| $\Delta\theta_{i,g}$  | -0.024 9 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 385  | $\lambda_5$      | 340 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 368  | $\lambda_{0.05}$ | 338 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.65 | 0.63             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.10             |
| 350                    | 0.41             |
| 360                    | 0.69             |
| 370                    | 0.83             |
| 380                    | 0.916            |
| 390                    | 0.951            |
| 400                    | 0.968            |
| 420                    | 0.982            |
| 440                    | 0.987            |
| 460                    | 0.990            |
| 480                    | 0.993            |
| 500                    | 0.995            |
| 550                    | 0.997            |
| 600                    | 0.996            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.999            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.996            |
| 1 400                  | 0.994            |
| 1 600                  | 0.992            |
| 1 800                  | 0.983            |
| 2 000                  | 0.966            |
| 2 200                  | 0.920            |
| 2 400                  | 0.77             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 588   |
| Annealing Point AP (°C)                                          | 614   |
| Transformation Temperature Tg (°C)                               | 631   |
| Yield Point At (°C)                                              | 666   |
| Softening Point SP (°C)                                          | 701   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 84    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 97    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.655 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 71                                             |
| -90 ~ -80                               | 72                                             |
| -80 ~ -70                               | 74                                             |
| -70 ~ -60                               | 75                                             |
| -60 ~ -50                               | 76                                             |
| -50 ~ -40                               | 77                                             |
| -40 ~ -30                               | 78                                             |
| -30 ~ -20                               | 79                                             |
| -20 ~ -10                               | 80                                             |
| -10 ~ 0                                 | 81                                             |
| 0 ~ 10                                  | 82                                             |
| 10 ~ 20                                 | 83                                             |
| 20 ~ 30                                 | 84                                             |
| 30 ~ 40                                 | 85                                             |
| 40 ~ 50                                 | 86                                             |
| 50 ~ 60                                 | 87                                             |
| 60 ~ 70                                 | 88                                             |
| 70 ~ 80                                 | 89                                             |
| 80 ~ 90                                 | 90                                             |
| 90 ~ 100                                | 91                                             |
| 100 ~ 110                               | 91                                             |
| 110 ~ 120                               | 92                                             |
| 120 ~ 130                               | 93                                             |
| 130 ~ 140                               | 94                                             |
| 140 ~ 150                               | 94                                             |
| 150 ~ 160                               | 95                                             |
| 160 ~ 170                               | 96                                             |
| 170 ~ 180                               | 96                                             |
| 180 ~ 190                               | 97                                             |
| 190 ~ 200                               | 97                                             |
| 200 ~ 210                               | 98                                             |
| 210 ~ 220                               | 99                                             |
| 220 ~ 230                               | 99                                             |
| 230 ~ 240                               | 100                                            |
| 240 ~ 250                               | 100                                            |
| 250 ~ 260                               | 101                                            |
| 260 ~ 270                               | 101                                            |
| 270 ~ 280                               | 101                                            |
| 280 ~ 290                               | 102                                            |
| 290 ~ 300                               | 102                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.51 |
| Specific Gravity $d$                                      | 4.25 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |     |     |     |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g   | h   | i   |
| -80 ~ -60                                    | -1.2                                                            | -1.0 | -0.8 | -0.7 | -0.7 | -0.5 | -0.3 | 0.0  | 0.1  | 0.5 | 1.0 | 1.7 |
| -60 ~ -40                                    | -1.4                                                            | -1.3 | -1.0 | -0.8 | -0.8 | -0.6 | -0.5 | -0.1 | -0.1 | 0.3 | 0.9 | 1.7 |
| -40 ~ -20                                    | -1.5                                                            | -1.3 | -1.0 | -0.9 | -0.9 | -0.7 | -0.5 | -0.1 | -0.1 | 0.4 | 0.8 | 1.8 |
| -20 ~ 0                                      | -1.5                                                            | -1.4 | -1.0 | -0.9 | -0.8 | -0.7 | -0.5 | -0.1 | 0.0  | 0.4 | 1.0 | 1.9 |
| 0 ~ 20                                       | -1.4                                                            | -1.3 | -0.9 | -0.8 | -0.8 | -0.6 | -0.4 | 0.0  | 0.0  | 0.6 | 1.1 | 2.1 |
| 20 ~ 40                                      | -1.3                                                            | -1.2 | -0.8 | -0.7 | -0.7 | -0.5 | -0.3 | 0.1  | 0.2  | 0.7 | 1.2 | 2.4 |
| 40 ~ 60                                      | -1.3                                                            | -1.1 | -0.7 | -0.6 | -0.6 | -0.4 | -0.2 | 0.3  | 0.3  | 1.0 | 1.5 | 2.6 |
| 60 ~ 80                                      | -1.3                                                            | -1.0 | -0.6 | -0.5 | -0.4 | -0.2 | 0.0  | 0.5  | 0.5  | 1.1 | 1.7 | 2.8 |
| 80 ~ 100                                     | -1.1                                                            | -1.0 | -0.5 | -0.4 | -0.4 | -0.1 | 0.1  | 0.7  | 0.7  | 1.3 | 1.9 | 3.1 |
| 100 ~ 120                                    | -1.1                                                            | -0.8 | -0.4 | -0.3 | -0.2 | 0.0  | 0.3  | 0.7  | 0.8  | 1.5 | 2.1 | 3.4 |
| 120 ~ 140                                    | -1.0                                                            | -0.8 | -0.3 | -0.2 | -0.1 | 0.2  | 0.4  | 1.0  | 1.0  | 1.7 | 2.3 | 3.6 |
| 140 ~ 160                                    | -0.9                                                            | -0.6 | -0.1 | 0.0  | 0.1  | 0.3  | 0.6  | 1.1  | 1.2  | 1.8 | 2.5 | 3.8 |
| 160 ~ 180                                    | -0.8                                                            | -0.6 | -0.1 | 0.1  | 0.1  | 0.4  | 0.7  | 1.2  | 1.3  | 2.0 | 2.7 | 4.0 |

S-LAM 7

Code(d) 750353  
Code(e) 755350

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.749 50<br>1.749 497 | Abbe Number $\nu_d$ | 35.28 | Dispersion $n_F - n_C$       | 0.021 243 |
| Refractive Index $n_e$ | 1.754 527             | Abbe Number $\nu_e$ | 35.02 | Dispersion $n_{F'} - n_{C'}$ | 0.021 544 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.705 83 |
| $n_{1970}$         | 1.970 09  | 1.711 84 |
| $n_{1530}$         | 1.529 58  | 1.718 66 |
| $n_{1129}$         | 1.128 64  | 1.725 53 |
| $n_t$              | 1.013 98  | 1.728 11 |
| $n_s$              | 0.852 11  | 1.732 96 |
| $n_{A'}$           | 0.768 19  | 1.736 49 |
| $n_F$              | 0.706 52  | 1.739 84 |
| $n_C$              | 0.656 27  | 1.743 28 |
| $n_{C'}$           | 0.643 85  | 1.744 25 |
| $n_{He-Ne}$        | 0.632 8   | 1.745 17 |
| $n_D$              | 0.589 29  | 1.749 31 |
| $n_d$              | 0.587 56  | 1.749 50 |
| $n_e$              | 0.546 07  | 1.754 53 |
| $n_F$              | 0.486 13  | 1.764 52 |
| $n_{F'}$           | 0.479 99  | 1.765 79 |
| $n_{He-Cd}$        | 0.441 57  | 1.775 30 |
| $n_g$              | 0.435 835 | 1.776 99 |
| $n_h$              | 0.404 656 | 1.787 87 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.710 147 12E+00 |
| $A_2$                           | 2.569 432 92E-01 |
| $A_3$                           | 1.639 862 71E+00 |
| $B_1$                           | 1.051 610 80E-02 |
| $B_2$                           | 5.028 096 36E-02 |
| $B_3$                           | 1.461 812 17E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 97.0  |
| Rigidity Modulus G (GPa) | 38.1  |
| Poisson's Ratio $\sigma$ | 0.273 |
| Knoop Hardness Hk[Class] | 570 6 |
| Abrasion Aa              | 140   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.015 167 |
| $n_C - n_{A'}$      | 0.006 783 |
| $n_d - n_C$         | 0.006 222 |
| $n_e - n_C$         | 0.011 252 |
| $n_g - n_d$         | 0.027 489 |
| $n_g - n_F$         | 0.012 468 |
| $n_h - n_g$         | 0.010 884 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.016 141 |
| $n_e - n_{C'}$      | 0.010 278 |
| $n_{F'} - n_e$      | 0.011 266 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.714 0 |
| $\theta_{C,A'}$              | 0.319 3 |
| $\theta_{d,C}$               | 0.292 9 |
| $\theta_{e,C}$               | 0.529 7 |
| $\theta_{g,d}$               | 1.294 0 |
| $\theta_{g,F}$               | 0.586 9 |
| $\theta_{h,g}$               | 0.512 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.749 2 |
| $\theta'_{e,C'}$             | 0.477 1 |
| $\theta'_{F',e}$             | 0.522 9 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.001 8 |
| $\Delta\theta_{C,A'}$ | 0.000 7 |
| $\Delta\theta_{g,d}$  | 0.002 6 |
| $\Delta\theta_{g,F}$  | 0.002 5 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 420  | $\lambda_5$      | 355 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 396  | $\lambda_{0.05}$ | 359 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.84 | 2.97             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.08             |
| 370                    | 0.34             |
| 380                    | 0.59             |
| 390                    | 0.75             |
| 400                    | 0.84             |
| 420                    | 0.935            |
| 440                    | 0.965            |
| 460                    | 0.977            |
| 480                    | 0.984            |
| 500                    | 0.989            |
| 550                    | 0.996            |
| 600                    | 0.997            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.996            |
| 1 600                  | 0.996            |
| 1 800                  | 0.990            |
| 2 000                  | 0.982            |
| 2 200                  | 0.950            |
| 2 400                  | 0.88             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 583   |
| Annealing Point AP (°C)                                          | 615   |
| Transformation Temperature Tg (°C)                               | 626   |
| Yield Point At (°C)                                              | 690   |
| Softening Point SP (°C)                                          | 739   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 68    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 81    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.871 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 55                                             |
| -90 ~ -80                               | 56                                             |
| -80 ~ -70                               | 57                                             |
| -70 ~ -60                               | 58                                             |
| -60 ~ -50                               | 60                                             |
| -50 ~ -40                               | 61                                             |
| -40 ~ -30                               | 62                                             |
| -30 ~ -20                               | 63                                             |
| -20 ~ -10                               | 64                                             |
| -10 ~ 0                                 | 65                                             |
| 0 ~ 10                                  | 66                                             |
| 10 ~ 20                                 | 67                                             |
| 20 ~ 30                                 | 68                                             |
| 30 ~ 40                                 | 69                                             |
| 40 ~ 50                                 | 70                                             |
| 50 ~ 60                                 | 71                                             |
| 60 ~ 70                                 | 72                                             |
| 70 ~ 80                                 | 73                                             |
| 80 ~ 90                                 | 74                                             |
| 90 ~ 100                                | 75                                             |
| 100 ~ 110                               | 75                                             |
| 110 ~ 120                               | 76                                             |
| 120 ~ 130                               | 77                                             |
| 130 ~ 140                               | 78                                             |
| 140 ~ 150                               | 78                                             |
| 150 ~ 160                               | 79                                             |
| 160 ~ 170                               | 79                                             |
| 170 ~ 180                               | 80                                             |
| 180 ~ 190                               | 81                                             |
| 190 ~ 200                               | 81                                             |
| 200 ~ 210                               | 82                                             |
| 210 ~ 220                               | 82                                             |
| 220 ~ 230                               | 83                                             |
| 230 ~ 240                               | 83                                             |
| 240 ~ 250                               | 83                                             |
| 250 ~ 260                               | 84                                             |
| 260 ~ 270                               | 84                                             |
| 270 ~ 280                               | 84                                             |
| 280 ~ 290                               | 85                                             |
| 290 ~ 300                               | 85                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.53 |
| Specific Gravity $d$                                     | 3.81 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | 3.2                                                             | 3.4 | 4.0 | 4.1 | 4.2 | 4.4 | 4.8 | 5.5 | 5.6 | 6.5 | 7.4 | - |
| -60 ~ -40                                    | 3.1                                                             | 3.4 | 3.9 | 4.1 | 4.1 | 4.4 | 4.7 | 5.5 | 5.6 | 6.5 | 7.5 | - |
| -40 ~ -20                                    | 3.2                                                             | 3.4 | 3.9 | 4.1 | 4.2 | 4.5 | 4.8 | 5.5 | 5.6 | 6.5 | 7.7 | - |
| -20 ~ 0                                      | 3.3                                                             | 3.5 | 4.1 | 4.3 | 4.3 | 4.6 | 4.9 | 5.8 | 5.9 | 6.8 | 7.9 | - |
| 0 ~ 20                                       | 3.4                                                             | 3.6 | 4.2 | 4.4 | 4.4 | 4.8 | 5.2 | 5.9 | 6.0 | 7.0 | 8.1 | - |
| 20 ~ 40                                      | 3.5                                                             | 3.8 | 4.4 | 4.6 | 4.6 | 4.9 | 5.3 | 6.1 | 6.2 | 7.2 | 8.4 | - |
| 40 ~ 60                                      | 3.6                                                             | 3.9 | 4.5 | 4.7 | 4.8 | 5.1 | 5.6 | 6.3 | 6.4 | 7.5 | 8.6 | - |
| 60 ~ 80                                      | 3.8                                                             | 4.1 | 4.7 | 4.9 | 5.0 | 5.3 | 5.7 | 6.5 | 6.6 | 7.6 | 8.8 | - |
| 80 ~ 100                                     | 3.8                                                             | 4.1 | 4.9 | 5.1 | 5.1 | 5.5 | 5.8 | 6.6 | 6.8 | 7.8 | 9.1 | - |
| 100 ~ 120                                    | 3.9                                                             | 4.3 | 4.9 | 5.2 | 5.3 | 5.6 | 6.0 | 6.8 | 6.9 | 8.1 | 9.3 | - |
| 120 ~ 140                                    | 4.0                                                             | 4.3 | 5.1 | 5.3 | 5.3 | 5.7 | 6.1 | 6.9 | 7.1 | 8.2 | 9.5 | - |
| 140 ~ 160                                    | 4.1                                                             | 4.4 | 5.1 | 5.3 | 5.4 | 5.7 | 6.1 | 7.0 | 7.1 | 8.3 | 9.6 | - |
| 160 ~ 180                                    | 4.1                                                             | 4.4 | 5.1 | 5.3 | 5.4 | 5.8 | 6.2 | 7.1 | 7.2 | 8.4 | 9.7 | - |

## S-LAM55

Code(d) 762401  
Code(e) 767398

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.762 00<br>1.762 001 | Abbe Number $\nu_d$ | 40.10 | Dispersion $n_F - n_C$       | 0.019 003 |
| Refractive Index $n_e$ | 1.766 509             | Abbe Number $\nu_e$ | 39.82 | Dispersion $n_{F'} - n_{C'}$ | 0.019 247 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.720 20 |
| $n_{1970}$         | 1.970 09  | 1.726 40 |
| $n_{1530}$         | 1.529 58  | 1.733 28 |
| $n_{1129}$         | 1.128 64  | 1.739 98 |
| $n_t$              | 1.013 98  | 1.742 42 |
| $n_s$              | 0.852 11  | 1.746 95 |
| $n_{A'}$           | 0.768 19  | 1.750 20 |
| $n_F$              | 0.706 52  | 1.753 27 |
| $n_C$              | 0.656 27  | 1.756 39 |
| $n_{C'}$           | 0.643 85  | 1.757 27 |
| $n_{He-Ne}$        | 0.632 8   | 1.758 10 |
| $n_D$              | 0.589 29  | 1.761 83 |
| $n_d$              | 0.587 56  | 1.762 00 |
| $n_e$              | 0.546 07  | 1.766 51 |
| $n_F$              | 0.486 13  | 1.775 39 |
| $n_{F'}$           | 0.479 99  | 1.776 52 |
| $n_{He-Cd}$        | 0.441 57  | 1.784 87 |
| $n_g$              | 0.435 835 | 1.786 34 |
| $n_h$              | 0.404 656 | 1.795 80 |
| $n_i$              | 0.365 015 | 1.812 80 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.854 129 79E+00 |
| $A_2$                           | 1.654 503 23E-01 |
| $A_3$                           | 1.272 554 22E+00 |
| $B_1$                           | 1.084 381 52E-02 |
| $B_2$                           | 5.140 509 80E-02 |
| $B_3$                           | 1.099 868 37E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 51.2 |
| Phosphate Resistance PR                   | 1.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 96.7  |
| Rigidity Modulus G (GPa) | 37.4  |
| Poisson's Ratio $\sigma$ | 0.292 |
| Knoop Hardness Hk[Class] | 590 6 |
| Abrasion Aa              | 145   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.013 960 |
| $n_C - n_{A'}$      | 0.006 182 |
| $n_d - n_C$         | 0.005 616 |
| $n_e - n_C$         | 0.010 124 |
| $n_g - n_d$         | 0.024 342 |
| $n_g - n_F$         | 0.010 955 |
| $n_h - n_g$         | 0.009 453 |
| $n_i - n_g$         | 0.026 457 |
| $n_{C'} - n_t$      | 0.014 843 |
| $n_e - n_{C'}$      | 0.009 241 |
| $n_{F'} - n_e$      | 0.010 006 |
| $n_i - n_{F'}$      | 0.036 285 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.734 6 |
| $\theta_{C,A'}$              | 0.325 3 |
| $\theta_{d,C}$               | 0.295 5 |
| $\theta_{e,C}$               | 0.532 8 |
| $\theta_{g,d}$               | 1.281 0 |
| $\theta_{g,F}$               | 0.576 5 |
| $\theta_{h,g}$               | 0.497 4 |
| $\theta_{i,g}$               | 1.392 3 |
| $\theta'_{C,t}$              | 0.771 2 |
| $\theta'_{e,C'}$             | 0.480 1 |
| $\theta'_{F',e}$             | 0.519 9 |
| $\theta'_{i,F'}$             | 1.885 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.000 2 |
| $\Delta\theta_{C,A'}$ | 0.000 8  |
| $\Delta\theta_{g,d}$  | -0.000 4 |
| $\Delta\theta_{g,F}$  | -0.000 1 |
| $\Delta\theta_{i,g}$  | 0.003 1  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 405  | $\lambda_5$      | 350 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 378  | $\lambda_{0.05}$ | 350 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.43 | 1.46             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.06             |
| 360                    | 0.37             |
| 370                    | 0.67             |
| 380                    | 0.82             |
| 390                    | 0.89             |
| 400                    | 0.932            |
| 420                    | 0.963            |
| 440                    | 0.976            |
| 460                    | 0.984            |
| 480                    | 0.989            |
| 500                    | 0.993            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.995            |
| 1 600                  | 0.994            |
| 1 800                  | 0.986            |
| 2 000                  | 0.970            |
| 2 200                  | 0.923            |
| 2 400                  | 0.78             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 589   |
| Annealing Point AP (°C)                                          | 617   |
| Transformation Temperature Tg (°C)                               | 633   |
| Yield Point At (°C)                                              | 671   |
| Softening Point SP (°C)                                          | 709   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 72    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 85    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.741 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 59                                             |
| -90 ~ -80                               | 61                                             |
| -80 ~ -70                               | 62                                             |
| -70 ~ -60                               | 63                                             |
| -60 ~ -50                               | 64                                             |
| -50 ~ -40                               | 65                                             |
| -40 ~ -30                               | 66                                             |
| -30 ~ -20                               | 67                                             |
| -20 ~ -10                               | 69                                             |
| -10 ~ 0                                 | 70                                             |
| 0 ~ 10                                  | 71                                             |
| 10 ~ 20                                 | 72                                             |
| 20 ~ 30                                 | 73                                             |
| 30 ~ 40                                 | 73                                             |
| 40 ~ 50                                 | 74                                             |
| 50 ~ 60                                 | 75                                             |
| 60 ~ 70                                 | 76                                             |
| 70 ~ 80                                 | 77                                             |
| 80 ~ 90                                 | 78                                             |
| 90 ~ 100                                | 79                                             |
| 100 ~ 110                               | 79                                             |
| 110 ~ 120                               | 80                                             |
| 120 ~ 130                               | 81                                             |
| 130 ~ 140                               | 82                                             |
| 140 ~ 150                               | 82                                             |
| 150 ~ 160                               | 83                                             |
| 160 ~ 170                               | 84                                             |
| 170 ~ 180                               | 84                                             |
| 180 ~ 190                               | 85                                             |
| 190 ~ 200                               | 86                                             |
| 200 ~ 210                               | 86                                             |
| 210 ~ 220                               | 87                                             |
| 220 ~ 230                               | 87                                             |
| 230 ~ 240                               | 88                                             |
| 240 ~ 250                               | 88                                             |
| 250 ~ 260                               | 89                                             |
| 260 ~ 270                               | 89                                             |
| 270 ~ 280                               | 89                                             |
| 280 ~ 290                               | 90                                             |
| 290 ~ 300                               | 90                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.88 |
| Specific Gravity $d$                                     | 4.22 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 1.7                                                             | 2.0 | 2.4 | 2.5 | 2.5 | 2.8 | 3.1 | 3.6 | 3.7 | 4.3 | 5.1 | 6.5  |
| -60 ~ -40                                    | 1.6                                                             | 1.8 | 2.2 | 2.3 | 2.4 | 2.6 | 3.0 | 3.5 | 3.6 | 4.2 | 4.9 | 6.5  |
| -40 ~ -20                                    | 1.4                                                             | 1.7 | 2.2 | 2.4 | 2.4 | 2.7 | 2.9 | 3.5 | 3.6 | 4.4 | 5.1 | 6.7  |
| -20 ~ 0                                      | 1.5                                                             | 1.7 | 2.2 | 2.4 | 2.4 | 2.7 | 3.1 | 3.7 | 3.7 | 4.5 | 5.3 | 7.1  |
| 0 ~ 20                                       | 1.5                                                             | 1.8 | 2.3 | 2.6 | 2.5 | 2.8 | 3.2 | 3.8 | 3.9 | 4.7 | 5.5 | 7.4  |
| 20 ~ 40                                      | 1.7                                                             | 1.9 | 2.5 | 2.6 | 2.7 | 3.0 | 3.3 | 4.1 | 4.1 | 5.0 | 5.8 | 7.7  |
| 40 ~ 60                                      | 1.8                                                             | 2.0 | 2.6 | 2.8 | 3.0 | 3.3 | 3.6 | 4.3 | 4.4 | 5.2 | 6.2 | 8.1  |
| 60 ~ 80                                      | 2.0                                                             | 2.2 | 2.8 | 3.0 | 3.1 | 3.4 | 3.8 | 4.5 | 4.6 | 5.5 | 6.6 | 8.6  |
| 80 ~ 100                                     | 2.0                                                             | 2.3 | 3.0 | 3.2 | 3.3 | 3.7 | 4.0 | 4.8 | 4.9 | 5.8 | 6.8 | 8.9  |
| 100 ~ 120                                    | 2.2                                                             | 2.5 | 3.1 | 3.4 | 3.5 | 3.9 | 4.2 | 5.0 | 5.1 | 6.1 | 7.2 | 9.4  |
| 120 ~ 140                                    | 2.3                                                             | 2.7 | 3.4 | 3.6 | 3.7 | 4.1 | 4.5 | 5.3 | 5.4 | 6.4 | 7.5 | 9.8  |
| 140 ~ 160                                    | 2.5                                                             | 2.9 | 3.6 | 3.8 | 3.9 | 4.3 | 4.7 | 5.5 | 5.6 | 6.7 | 7.8 | 10.2 |
| 160 ~ 180                                    | 2.6                                                             | 3.0 | 3.7 | 4.0 | 4.0 | 4.4 | 4.8 | 5.7 | 5.8 | 6.9 | 8.1 | 10.7 |

OHARA 25-04

## S-LAM60

Code(d) 743493

Code(e) 747491

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.743 20<br>1.743 198 | Abbe Number $\nu_d$ | 49.34 | Dispersion $n_F - n_C$       | 0.015 063 |
| Refractive Index $n_e$ | 1.746 784             | Abbe Number $\nu_e$ | 49.10 | Dispersion $n_{F'} - n_{C'}$ | 0.015 210 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.701 81 |
| $n_{1970}$         | 1.970 09  | 1.709 32 |
| $n_{1530}$         | 1.529 58  | 1.717 30 |
| $n_{1129}$         | 1.128 64  | 1.724 31 |
| $n_t$              | 1.013 98  | 1.726 63 |
| $n_s$              | 0.852 11  | 1.730 71 |
| $n_{A'}$           | 0.768 19  | 1.733 51 |
| $n_F$              | 0.706 52  | 1.736 08 |
| $n_C$              | 0.656 27  | 1.738 65 |
| $n_{C'}$           | 0.643 85  | 1.739 37 |
| $n_{He-Ne}$        | 0.632 8   | 1.740 05 |
| $n_D$              | 0.589 29  | 1.743 06 |
| $n_d$              | 0.587 56  | 1.743 20 |
| $n_e$              | 0.546 07  | 1.746 78 |
| $n_F$              | 0.486 13  | 1.753 72 |
| $n_{F'}$           | 0.479 99  | 1.754 58 |
| $n_{He-Cd}$        | 0.441 57  | 1.760 94 |
| $n_g$              | 0.435 835 | 1.762 05 |
| $n_h$              | 0.404 656 | 1.769 04 |
| $n_i$              | 0.365 015 | 1.781 13 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.606 730 56E+00 |
| $A_2$                           | 3.664 156 40E-01 |
| $A_3$                           | 1.317 618 04E+00 |
| $B_1$                           | 7.750 461 40E-03 |
| $B_2$                           | 2.899 676 11E-02 |
| $B_3$                           | 9.307 207 09E+01 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 2    |
| Acid Resistance(Surface) Group SR         | 52.0 |
| Phosphate Resistance PR                   | 2.0  |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 113.2 |   |
| Rigidity Modulus G (GPa) | 43.8  |   |
| Poisson's Ratio $\sigma$ | 0.294 |   |
| Knoop Hardness Hk[Class] | 700   | 7 |
| Abrasion Aa              | 70    |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.012 019 |
| $n_C - n_{A'}$      | 0.005 143 |
| $n_d - n_C$         | 0.004 545 |
| $n_e - n_C$         | 0.008 131 |
| $n_g - n_d$         | 0.018 849 |
| $n_g - n_F$         | 0.008 331 |
| $n_h - n_g$         | 0.006 993 |
| $n_i - n_g$         | 0.019 083 |
| $n_{C'} - n_t$      | 0.012 740 |
| $n_e - n_{C'}$      | 0.007 410 |
| $n_{F'} - n_e$      | 0.007 800 |
| $n_i - n_{F'}$      | 0.026 546 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.797 9 |
| $\theta_{C,A'}$              | 0.341 4 |
| $\theta_{d,C}$               | 0.301 7 |
| $\theta_{e,C}$               | 0.539 8 |
| $\theta_{g,d}$               | 1.251 3 |
| $\theta_{g,F}$               | 0.553 1 |
| $\theta_{h,g}$               | 0.464 3 |
| $\theta_{i,g}$               | 1.266 9 |
| $\theta'_{C,t}$              | 0.837 6 |
| $\theta'_{e,C'}$             | 0.487 2 |
| $\theta'_{F,e}$              | 0.512 8 |
| $\theta'_{i,F'}$             | 1.745 3 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.019 7  |
| $\Delta\theta_{C,A'}$ | 0.005 7  |
| $\Delta\theta_{g,d}$  | -0.010 9 |
| $\Delta\theta_{g,F}$  | -0.008 5 |
| $\Delta\theta_{i,g}$  | -0.045 0 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 375  | $\lambda_5$      | 330 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 360  | $\lambda_{0.05}$ | 331 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.51 | 0.52             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.03             |
| 340                    | 0.29             |
| 350                    | 0.60             |
| 360                    | 0.79             |
| 370                    | 0.89             |
| 380                    | 0.937            |
| 390                    | 0.961            |
| 400                    | 0.974            |
| 420                    | 0.985            |
| 440                    | 0.990            |
| 460                    | 0.993            |
| 480                    | 0.995            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.991            |
| 1 600                  | 0.991            |
| 1 800                  | 0.980            |
| 2 000                  | 0.953            |
| 2 200                  | 0.87             |
| 2 400                  | 0.62             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 594   |
| Annealing Point AP (°C)                                          | 615   |
| Transformation Temperature Tg (°C)                               | 637   |
| Yield Point At (°C)                                              | 665   |
| Softening Point SP (°C)                                          | 693   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 55    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 69    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.845 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 42                                             |
| -90 ~ -80                               | 43                                             |
| -80 ~ -70                               | 44                                             |
| -70 ~ -60                               | 46                                             |
| -60 ~ -50                               | 47                                             |
| -50 ~ -40                               | 48                                             |
| -40 ~ -30                               | 49                                             |
| -30 ~ -20                               | 50                                             |
| -20 ~ -10                               | 51                                             |
| -10 ~ 0                                 | 52                                             |
| 0 ~ 10                                  | 53                                             |
| 10 ~ 20                                 | 54                                             |
| 20 ~ 30                                 | 55                                             |
| 30 ~ 40                                 | 56                                             |
| 40 ~ 50                                 | 57                                             |
| 50 ~ 60                                 | 58                                             |
| 60 ~ 70                                 | 59                                             |
| 70 ~ 80                                 | 60                                             |
| 80 ~ 90                                 | 61                                             |
| 90 ~ 100                                | 61                                             |
| 100 ~ 110                               | 62                                             |
| 110 ~ 120                               | 63                                             |
| 120 ~ 130                               | 64                                             |
| 130 ~ 140                               | 65                                             |
| 140 ~ 150                               | 65                                             |
| 150 ~ 160                               | 66                                             |
| 160 ~ 170                               | 67                                             |
| 170 ~ 180                               | 67                                             |
| 180 ~ 190                               | 68                                             |
| 190 ~ 200                               | 69                                             |
| 200 ~ 210                               | 69                                             |
| 210 ~ 220                               | 70                                             |
| 220 ~ 230                               | 70                                             |
| 230 ~ 240                               | 71                                             |
| 240 ~ 250                               | 72                                             |
| 250 ~ 260                               | 72                                             |
| 260 ~ 270                               | 73                                             |
| 270 ~ 280                               | 73                                             |
| 280 ~ 290                               | 74                                             |
| 290 ~ 300                               | 74                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.90 |
| Specific Gravity $d$                                     | 4.06 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 4.3                                                             | 4.5 | 4.9 | 5.0 | 5.0 | 5.2 | 5.4 | 5.7 | 5.8 | 6.3 | 6.8 | 7.7 |
| -60 ~ -40                                    | 4.2                                                             | 4.5 | 4.8 | 5.0 | 5.0 | 5.2 | 5.3 | 5.8 | 5.9 | 6.3 | 6.8 | 7.8 |
| -40 ~ -20                                    | 4.3                                                             | 4.5 | 4.9 | 5.0 | 5.1 | 5.3 | 5.5 | 5.8 | 5.9 | 6.3 | 6.9 | 7.8 |
| -20 ~ 0                                      | 4.5                                                             | 4.6 | 5.0 | 5.1 | 5.2 | 5.3 | 5.5 | 6.0 | 6.1 | 6.5 | 7.0 | 7.9 |
| 0 ~ 20                                       | 4.6                                                             | 4.8 | 5.1 | 5.2 | 5.3 | 5.5 | 5.7 | 6.2 | 6.2 | 6.7 | 7.2 | 8.1 |
| 20 ~ 40                                      | 4.7                                                             | 4.9 | 5.3 | 5.4 | 5.5 | 5.7 | 5.9 | 6.3 | 6.3 | 6.9 | 7.4 | 8.4 |
| 40 ~ 60                                      | 4.9                                                             | 5.1 | 5.4 | 5.6 | 5.6 | 5.8 | 6.0 | 6.5 | 6.6 | 7.1 | 7.6 | 8.5 |
| 60 ~ 80                                      | 5.1                                                             | 5.3 | 5.7 | 5.8 | 5.8 | 6.0 | 6.2 | 6.6 | 6.7 | 7.2 | 7.7 | 8.7 |
| 80 ~ 100                                     | 5.1                                                             | 5.3 | 5.7 | 5.9 | 6.0 | 6.2 | 6.4 | 6.8 | 6.9 | 7.4 | 7.9 | 8.9 |
| 100 ~ 120                                    | 5.2                                                             | 5.4 | 5.8 | 6.0 | 6.1 | 6.3 | 6.5 | 7.0 | 7.0 | 7.6 | 8.1 | 9.1 |
| 120 ~ 140                                    | 5.3                                                             | 5.5 | 6.0 | 6.1 | 6.2 | 6.4 | 6.6 | 7.1 | 7.1 | 7.6 | 8.2 | 9.2 |
| 140 ~ 160                                    | 5.3                                                             | 5.6 | 6.1 | 6.2 | 6.2 | 6.5 | 6.7 | 7.1 | 7.2 | 7.7 | 8.3 | 9.3 |
| 160 ~ 180                                    | 5.4                                                             | 5.6 | 6.1 | 6.2 | 6.2 | 6.5 | 6.7 | 7.1 | 7.2 | 7.7 | 8.3 | 9.4 |

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## S-LAM66

Code(d) 801350

Code(e) 806347

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.801 00<br>1.800 999 | Abbe Number $\nu_d$ | 34.97 | Dispersion $n_F - n_C$       | 0.022 907 |
| Refractive Index $n_e$ | 1.806 423             | Abbe Number $\nu_e$ | 34.72 | Dispersion $n_{F'} - n_{C'}$ | 0.023 227 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.750 94 |
| $n_{1970}$         | 1.970 09  | 1.758 42 |
| $n_{1530}$         | 1.529 58  | 1.766 72 |
| $n_{1129}$         | 1.128 64  | 1.774 75 |
| $n_t$              | 1.013 98  | 1.777 66 |
| $n_s$              | 0.852 11  | 1.783 04 |
| $n_{A'}$           | 0.768 19  | 1.786 91 |
| $n_F$              | 0.706 52  | 1.790 55 |
| $n_C$              | 0.656 27  | 1.794 27 |
| $n_{C'}$           | 0.643 85  | 1.795 33 |
| $n_{He-Ne}$        | 0.632 8   | 1.796 32 |
| $n_D$              | 0.589 29  | 1.800 80 |
| $n_d$              | 0.587 56  | 1.801 00 |
| $n_e$              | 0.546 07  | 1.806 42 |
| $n_F$              | 0.486 13  | 1.817 18 |
| $n_{F'}$           | 0.479 99  | 1.818 56 |
| $n_{He-Cd}$        | 0.441 57  | 1.828 79 |
| $n_g$              | 0.435 835 | 1.830 61 |
| $n_h$              | 0.404 656 | 1.842 36 |
| $n_i$              | 0.365 015 | 1.863 91 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.920 942 21E+00 |
| $A_2$                           | 2.199 012 08E-01 |
| $A_3$                           | 1.727 052 31E+00 |
| $B_1$                           | 1.150 752 41E-02 |
| $B_2$                           | 5.479 935 43E-02 |
| $B_3$                           | 1.201 336 74E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 3   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 4.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 121.0   |
| Rigidity Modulus G (GPa) | 47.3    |
| Poisson's Ratio $\sigma$ | 0.280   |
| Knoop Hardness Hk[Class] | 660   7 |
| Abrasion Aa              | 93      |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.016 620 |
| $n_C - n_{A'}$      | 0.007 369 |
| $n_d - n_C$         | 0.006 724 |
| $n_e - n_C$         | 0.012 148 |
| $n_g - n_d$         | 0.029 615 |
| $n_g - n_F$         | 0.013 432 |
| $n_h - n_g$         | 0.011 747 |
| $n_i - n_g$         | 0.033 294 |
| $n_{C'} - n_t$      | 0.017 674 |
| $n_e - n_{C'}$      | 0.011 094 |
| $n_{F'} - n_e$      | 0.012 133 |
| $n_i - n_{F'}$      | 0.045 352 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.725 5 |
| $\theta_{C,A'}$              | 0.321 7 |
| $\theta_{d,C}$               | 0.293 5 |
| $\theta_{e,C}$               | 0.530 3 |
| $\theta_{g,d}$               | 1.292 8 |
| $\theta_{g,F}$               | 0.586 4 |
| $\theta_{h,g}$               | 0.512 8 |
| $\theta_{i,g}$               | 1.453 4 |
| $\theta'_{C,t}$              | 0.760 9 |
| $\theta'_{e,C'}$             | 0.477 6 |
| $\theta'_{F',e}$             | 0.522 4 |
| $\theta'_{i,F'}$             | 1.952 6 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.014 8 |
| $\Delta\theta_{C,A'}$ | 0.003 5 |
| $\Delta\theta_{g,d}$  | 0.000 7 |
| $\Delta\theta_{g,F}$  | 0.001 5 |
| $\Delta\theta_{i,g}$  | 0.021 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 430  | $\lambda_5$      | 350 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 388  | $\lambda_{0.05}$ | 351 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.58 | 2.67             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.03             |
| 360                    | 0.28             |
| 370                    | 0.57             |
| 380                    | 0.73             |
| 390                    | 0.82             |
| 400                    | 0.87             |
| 420                    | 0.932            |
| 440                    | 0.954            |
| 460                    | 0.968            |
| 480                    | 0.977            |
| 500                    | 0.985            |
| 550                    | 0.994            |
| 600                    | 0.994            |
| 650                    | 0.994            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.997            |
| 1 800                  | 0.992            |
| 2 000                  | 0.976            |
| 2 200                  | 0.937            |
| 2 400                  | 0.77             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 514  |
| Annealing Point AP (°C)                                          | 544  |
| Transformation Temperature Tg (°C)                               | 556  |
| Yield Point At (°C)                                              | 596  |
| Softening Point SP (°C)                                          | 629  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 80   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 97   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.06 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 63                                             |
| -90 ~ -80                               | 64                                             |
| -80 ~ -70                               | 66                                             |
| -70 ~ -60                               | 68                                             |
| -60 ~ -50                               | 69                                             |
| -50 ~ -40                               | 71                                             |
| -40 ~ -30                               | 72                                             |
| -30 ~ -20                               | 74                                             |
| -20 ~ -10                               | 75                                             |
| -10 ~ 0                                 | 77                                             |
| 0 ~ 10                                  | 78                                             |
| 10 ~ 20                                 | 79                                             |
| 20 ~ 30                                 | 80                                             |
| 30 ~ 40                                 | 82                                             |
| 40 ~ 50                                 | 83                                             |
| 50 ~ 60                                 | 84                                             |
| 60 ~ 70                                 | 85                                             |
| 70 ~ 80                                 | 86                                             |
| 80 ~ 90                                 | 88                                             |
| 90 ~ 100                                | 89                                             |
| 100 ~ 110                               | 90                                             |
| 110 ~ 120                               | 91                                             |
| 120 ~ 130                               | 92                                             |
| 130 ~ 140                               | 93                                             |
| 140 ~ 150                               | 94                                             |
| 150 ~ 160                               | 94                                             |
| 160 ~ 170                               | 95                                             |
| 170 ~ 180                               | 96                                             |
| 180 ~ 190                               | 97                                             |
| 190 ~ 200                               | 98                                             |
| 200 ~ 210                               | 98                                             |
| 210 ~ 220                               | 99                                             |
| 220 ~ 230                               | 100                                            |
| 230 ~ 240                               | 100                                            |
| 240 ~ 250                               | 101                                            |
| 250 ~ 260                               | 101                                            |
| 260 ~ 270                               | 102                                            |
| 270 ~ 280                               | 102                                            |
| 280 ~ 290                               | 103                                            |
| 290 ~ 300                               | 103                                            |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 1.92 |
| Specific Gravity $d$                        | 3.55 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 1.3                                                             | 1.5 | 2.1 | 2.2 | 2.3 | 2.6 | 2.8 | 3.6 | 3.7 | 4.5 | 5.5 | 7.5  |
| -60 ~ -40                                    | 1.1                                                             | 1.4 | 2.0 | 2.1 | 2.2 | 2.5 | 2.8 | 3.5 | 3.6 | 4.5 | 5.5 | 7.7  |
| -40 ~ -20                                    | 1.0                                                             | 1.4 | 1.9 | 2.1 | 2.2 | 2.5 | 2.8 | 3.6 | 3.7 | 4.6 | 5.7 | 8.0  |
| -20 ~ 0                                      | 1.1                                                             | 1.4 | 2.0 | 2.2 | 2.3 | 2.6 | 3.0 | 3.7 | 3.8 | 4.9 | 6.0 | 8.4  |
| 0 ~ 20                                       | 1.2                                                             | 1.5 | 2.1 | 2.3 | 2.4 | 2.8 | 3.1 | 3.9 | 4.0 | 5.1 | 6.3 | 8.8  |
| 20 ~ 40                                      | 1.3                                                             | 1.6 | 2.3 | 2.5 | 2.6 | 3.0 | 3.3 | 4.2 | 4.3 | 5.3 | 6.6 | 9.4  |
| 40 ~ 60                                      | 1.4                                                             | 1.8 | 2.4 | 2.7 | 2.8 | 3.1 | 3.5 | 4.4 | 4.5 | 5.6 | 6.9 | 9.8  |
| 60 ~ 80                                      | 1.6                                                             | 1.9 | 2.6 | 2.8 | 2.9 | 3.3 | 3.7 | 4.6 | 4.8 | 6.0 | 7.3 | 10.3 |
| 80 ~ 100                                     | 1.7                                                             | 2.0 | 2.8 | 3.0 | 3.1 | 3.5 | 3.9 | 4.9 | 5.0 | 6.3 | 7.6 | 10.8 |
| 100 ~ 120                                    | 1.8                                                             | 2.2 | 2.9 | 3.2 | 3.3 | 3.7 | 4.2 | 5.1 | 5.3 | 6.6 | 8.0 | 11.2 |
| 120 ~ 140                                    | 1.9                                                             | 2.3 | 3.1 | 3.3 | 3.4 | 3.9 | 4.3 | 5.4 | 5.5 | 6.9 | 8.3 | 11.7 |
| 140 ~ 160                                    | 2.0                                                             | 2.4 | 3.2 | 3.5 | 3.6 | 4.0 | 4.5 | 5.6 | 5.7 | 7.1 | 8.7 | 12.2 |
| 160 ~ 180                                    | 2.0                                                             | 2.4 | 3.3 | 3.6 | 3.7 | 4.1 | 4.6 | 5.7 | 6.0 | 7.4 | 9.0 | 12.6 |

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## S-LAM73

Code(d) **794371**  
Code(e) **799368**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.793 60</b><br>1.793 600 | Abbe Number $\nu_d$ | <b>37.09</b> | Dispersion $n_F - n_C$       | <b>0.021 397</b> |
| Refractive Index $n_e$ | 1.798 672                    | Abbe Number $\nu_e$ | 36.82        | Dispersion $n_{F'} - n_{C'}$ | 0.021 692        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.750 73 |
| $n_{1970}$         | 1.970 09  | 1.756 38 |
| $n_{1530}$         | 1.529 58  | 1.762 85 |
| $n_{1129}$         | 1.128 64  | 1.769 52 |
| $n_t$              | 1.013 98  | 1.772 07 |
| $n_s$              | 0.852 11  | 1.776 92 |
| $n_{A'}$           | 0.768 19  | 1.780 47 |
| $n_F$              | 0.706 52  | 1.783 85 |
| $n_C$              | 0.656 27  | 1.787 32 |
| $n_{C'}$           | 0.643 85  | 1.788 30 |
| $n_{\text{He-Ne}}$ | 0.632 8   | 1.789 23 |
| $n_D$              | 0.589 29  | 1.793 41 |
| $n_d$              | 0.587 56  | 1.793 60 |
| $n_e$              | 0.546 07  | 1.798 67 |
| $n_F$              | 0.486 13  | 1.808 72 |
| $n_{F'}$           | 0.479 99  | 1.810 00 |
| $n_{\text{He-Cd}}$ | 0.441 57  | 1.819 50 |
| $n_g$              | 0.435 835 | 1.821 19 |
| $n_h$              | 0.404 656 | 1.832 00 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.863 531 23E+00 |
| $A_2$                           | 2.552 156 17E-01 |
| $A_3$                           | 1.233 991 33E+00 |
| $B_1$                           | 1.076 206 73E-02 |
| $B_2$                           | 4.872 486 79E-02 |
| $B_3$                           | 1.171 251 10E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 4    |
| Weathering Resistance(Surface) Group W(S) | 3    |
| Acid Resistance(Surface) Group SR         | 52.2 |
| Phosphate Resistance PR                   | 2.2  |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 86.8  |   |
| Rigidity Modulus G (GPa) | 33.2  |   |
| Poisson's Ratio $\sigma$ | 0.306 |   |
| Knoop Hardness Hk[Class] | 520   | 5 |
| Abrasion Aa              | 182   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.015 250 |
| $n_C - n_{A'}$      | 0.006 846 |
| $n_d - n_C$         | 0.006 281 |
| $n_e - n_C$         | 0.011 353 |
| $n_g - n_d$         | 0.027 586 |
| $n_g - n_F$         | 0.012 470 |
| $n_h - n_g$         | 0.010 815 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.016 234 |
| $n_e - n_{C'}$      | 0.010 369 |
| $n_{F'} - n_e$      | 0.011 323 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.712 7 |
| $\theta_{C,A'}$              | 0.320 0 |
| $\theta_{d,C}$               | 0.293 5 |
| $\theta_{e,C}$               | 0.530 6 |
| $\theta_{g,d}$               | 1.289 2 |
| $\theta_{g,F}$               | 0.582 8 |
| $\theta_{h,g}$               | 0.505 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.748 4 |
| $\theta'_{e,C'}$             | 0.478 0 |
| $\theta'_{F',e}$             | 0.522 0 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.008 0 |
| $\Delta\theta_{C,A'}$ | -0.000 8 |
| $\Delta\theta_{g,d}$  | 0.001 5  |
| $\Delta\theta_{g,F}$  | 0.001 3  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 415  | $\lambda_5$      | 350 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 382  | $\lambda_{0.05}$ | 349 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.77 | 1.79             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.08             |
| 360                    | 0.34             |
| 370                    | 0.62             |
| 380                    | 0.78             |
| 390                    | 0.87             |
| 400                    | 0.916            |
| 420                    | 0.954            |
| 440                    | 0.968            |
| 460                    | 0.976            |
| 480                    | 0.983            |
| 500                    | 0.989            |
| 550                    | 0.995            |
| 600                    | 0.994            |
| 650                    | 0.994            |
| 700                    | 0.996            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.997            |
| 1 600                  | 0.995            |
| 1 800                  | 0.984            |
| 2 000                  | 0.964            |
| 2 200                  | 0.925            |
| 2 400                  | 0.80             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 584   |
| Annealing Point AP (°C)                                          | 607   |
| Transformation Temperature Tg (°C)                               | 625   |
| Yield Point At (°C)                                              | 665   |
| Softening Point SP (°C)                                          | 695   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 95    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 107   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.648 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 83                                             |
| -90 ~ -80                               | 84                                             |
| -80 ~ -70                               | 85                                             |
| -70 ~ -60                               | 86                                             |
| -60 ~ -50                               | 87                                             |
| -50 ~ -40                               | 88                                             |
| -40 ~ -30                               | 89                                             |
| -30 ~ -20                               | 90                                             |
| -20 ~ -10                               | 91                                             |
| -10 ~ 0                                 | 92                                             |
| 0 ~ 10                                  | 93                                             |
| 10 ~ 20                                 | 94                                             |
| 20 ~ 30                                 | 95                                             |
| 30 ~ 40                                 | 96                                             |
| 40 ~ 50                                 | 97                                             |
| 50 ~ 60                                 | 98                                             |
| 60 ~ 70                                 | 99                                             |
| 70 ~ 80                                 | 99                                             |
| 80 ~ 90                                 | 100                                            |
| 90 ~ 100                                | 101                                            |
| 100 ~ 110                               | 102                                            |
| 110 ~ 120                               | 102                                            |
| 120 ~ 130                               | 103                                            |
| 130 ~ 140                               | 104                                            |
| 140 ~ 150                               | 104                                            |
| 150 ~ 160                               | 105                                            |
| 160 ~ 170                               | 105                                            |
| 170 ~ 180                               | 106                                            |
| 180 ~ 190                               | 106                                            |
| 190 ~ 200                               | 107                                            |
| 200 ~ 210                               | 107                                            |
| 210 ~ 220                               | 108                                            |
| 220 ~ 230                               | 108                                            |
| 230 ~ 240                               | 109                                            |
| 240 ~ 250                               | 109                                            |
| 250 ~ 260                               | 110                                            |
| 260 ~ 270                               | 110                                            |
| 270 ~ 280                               | 110                                            |
| 280 ~ 290                               | 111                                            |
| 290 ~ 300                               | 111                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.52 |
| Specific Gravity $d$                                     | 4.45 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                        |      |      |      |      |      |      |      |      |     |     |   |
|----------------------------------------------|------------------------------------------------------------------------|------|------|------|------|------|------|------|------|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{\text{rel}} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |     |     |   |
|                                              | 1550                                                                   | t    | r    | C    | C'   | d    | e    | F    | F'   | g   | h   | i |
| -80 ~ -60                                    | -2.6                                                                   | -2.4 | -1.9 | -1.7 | -1.7 | -1.4 | -1.2 | -0.5 | -0.4 | 0.4 | 1.1 | - |
| -60 ~ -40                                    | -2.8                                                                   | -2.6 | -2.0 | -1.9 | -1.8 | -1.6 | -1.3 | -0.7 | -0.6 | 0.3 | 1.1 | - |
| -40 ~ -20                                    | -2.8                                                                   | -2.6 | -2.1 | -2.0 | -1.9 | -1.6 | -1.3 | -0.6 | -0.5 | 0.3 | 1.2 | - |
| -20 ~ 0                                      | -2.9                                                                   | -2.7 | -2.0 | -1.9 | -1.8 | -1.5 | -1.2 | -0.5 | -0.4 | 0.4 | 1.4 | - |
| 0 ~ 20                                       | -2.9                                                                   | -2.5 | -2.0 | -1.8 | -1.7 | -1.4 | -1.1 | -0.4 | -0.3 | 0.6 | 1.7 | - |
| 20 ~ 40                                      | -2.8                                                                   | -2.5 | -1.9 | -1.6 | -1.6 | -1.2 | -0.9 | -0.2 | -0.1 | 0.8 | 1.9 | - |
| 40 ~ 60                                      | -2.7                                                                   | -2.4 | -1.7 | -1.5 | -1.4 | -1.1 | -0.7 | 0.0  | 0.1  | 1.1 | 2.1 | - |
| 60 ~ 80                                      | -2.5                                                                   | -2.2 | -1.6 | -1.4 | -1.3 | -1.0 | -0.6 | 0.2  | 0.3  | 1.4 | 2.5 | - |
| 80 ~ 100                                     | -2.4                                                                   | -2.1 | -1.5 | -1.2 | -1.2 | -0.8 | -0.4 | 0.4  | 0.5  | 1.6 | 2.7 | - |
| 100 ~ 120                                    | -2.3                                                                   | -2.0 | -1.3 | -1.1 | -1.0 | -0.6 | -0.2 | 0.6  | 0.7  | 1.8 | 3.0 | - |
| 120 ~ 140                                    | -2.2                                                                   | -1.9 | -1.2 | -1.0 | -0.9 | -0.5 | -0.1 | 0.8  | 0.9  | 2.1 | 3.3 | - |
| 140 ~ 160                                    | -2.2                                                                   | -1.8 | -1.1 | -0.8 | -0.8 | -0.4 | 0.1  | 1.0  | 1.1  | 2.3 | 3.5 | - |
| 160 ~ 180                                    | -2.1                                                                   | -1.8 | -1.0 | -0.8 | -0.7 | -0.3 | 0.2  | 1.1  | 1.4  | 2.6 | 3.9 | - |

OHARA 25-04

S-NBH 5

Code(d) 654397  
Code(e) 658395

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.654 12<br>1.654 115 | Abbe Number $\nu_d$ | 39.68 | Dispersion $n_F - n_C$       | 0.016 484 |
| Refractive Index $n_e$ | 1.658 026             | Abbe Number $\nu_e$ | 39.43 | Dispersion $n_{F'} - n_{C'}$ | 0.016 687 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.614 10 |
| $n_{1970}$         | 1.970 09  | 1.620 70 |
| $n_{1530}$         | 1.529 58  | 1.627 87 |
| $n_{1129}$         | 1.128 64  | 1.634 48 |
| $n_t$              | 1.013 98  | 1.636 77 |
| $n_s$              | 0.852 11  | 1.640 90 |
| $n_{A'}$           | 0.768 19  | 1.643 79 |
| $n_F$              | 0.706 52  | 1.646 49 |
| $n_C$              | 0.656 27  | 1.649 23 |
| $n_{C'}$           | 0.643 85  | 1.650 00 |
| $n_{He-Ne}$        | 0.632 8   | 1.650 72 |
| $n_D$              | 0.589 29  | 1.653 97 |
| $n_d$              | 0.587 56  | 1.654 12 |
| $n_e$              | 0.546 07  | 1.658 03 |
| $n_F$              | 0.486 13  | 1.665 71 |
| $n_{F'}$           | 0.479 99  | 1.666 68 |
| $n_{He-Cd}$        | 0.441 57  | 1.673 89 |
| $n_g$              | 0.435 835 | 1.675 17 |
| $n_h$              | 0.404 656 | 1.683 31 |
| $n_i$              | 0.365 015 | 1.697 91 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.475 445 21E+00 |
| $A_2$                           | 1.930 600 95E-01 |
| $A_3$                           | 1.509 390 10E+00 |
| $B_1$                           | 9.558 367 40E-03 |
| $B_2$                           | 4.604 304 83E-02 |
| $B_3$                           | 1.264 227 46E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 90.2  |
| Rigidity Modulus G (GPa) | 36.1  |
| Poisson's Ratio $\sigma$ | 0.248 |
| Knoop Hardness Hk[Class] | 570 6 |
| Abrasion Aa              | 123   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.012 452 |
| $n_C - n_{A'}$      | 0.005 432 |
| $n_d - n_C$         | 0.004 890 |
| $n_e - n_C$         | 0.008 801 |
| $n_g - n_d$         | 0.021 051 |
| $n_g - n_F$         | 0.009 457 |
| $n_h - n_g$         | 0.008 144 |
| $n_i - n_g$         | 0.022 741 |
| $n_{C'} - n_t$      | 0.013 223 |
| $n_e - n_{C'}$      | 0.008 030 |
| $n_{F'} - n_e$      | 0.008 657 |
| $n_i - n_{F'}$      | 0.031 224 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.755 4 |
| $\theta_{C,A'}$              | 0.329 5 |
| $\theta_{d,C}$               | 0.296 7 |
| $\theta_{e,C}$               | 0.533 9 |
| $\theta_{g,d}$               | 1.277 1 |
| $\theta_{g,F}$               | 0.573 7 |
| $\theta_{h,g}$               | 0.494 1 |
| $\theta_{i,g}$               | 1.379 6 |
| $\theta'_{C,t}$              | 0.792 4 |
| $\theta'_{e,C'}$             | 0.481 2 |
| $\theta'_{F',e}$             | 0.518 8 |
| $\theta'_{i,F'}$             | 1.871 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.022 6  |
| $\Delta\theta_{C,A'}$ | 0.005 6  |
| $\Delta\theta_{g,d}$  | -0.005 2 |
| $\Delta\theta_{g,F}$  | -0.003 6 |
| $\Delta\theta_{i,g}$  | -0.013 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 370  | $\lambda_5$      | 325 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 357  | $\lambda_{0.05}$ | 328 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.66 | 0.69             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.12             |
| 340                    | 0.47             |
| 350                    | 0.71             |
| 360                    | 0.83             |
| 370                    | 0.902            |
| 380                    | 0.936            |
| 390                    | 0.957            |
| 400                    | 0.969            |
| 420                    | 0.980            |
| 440                    | 0.985            |
| 460                    | 0.988            |
| 480                    | 0.991            |
| 500                    | 0.994            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.991            |
| 1 600                  | 0.994            |
| 1 800                  | 0.989            |
| 2 000                  | 0.976            |
| 2 200                  | 0.919            |
| 2 400                  | 0.80             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 489   |
| Annealing Point AP (°C)                                          | 511   |
| Transformation Temperature Tg (°C)                               | 526   |
| Yield Point At (°C)                                              | 585   |
| Softening Point SP (°C)                                          | 645   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 68    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 85    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.965 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 53                                             |
| -90 ~ -80                               | 55                                             |
| -80 ~ -70                               | 56                                             |
| -70 ~ -60                               | 57                                             |
| -60 ~ -50                               | 59                                             |
| -50 ~ -40                               | 60                                             |
| -40 ~ -30                               | 61                                             |
| -30 ~ -20                               | 62                                             |
| -20 ~ -10                               | 64                                             |
| -10 ~ 0                                 | 65                                             |
| 0 ~ 10                                  | 66                                             |
| 10 ~ 20                                 | 67                                             |
| 20 ~ 30                                 | 68                                             |
| 30 ~ 40                                 | 69                                             |
| 40 ~ 50                                 | 70                                             |
| 50 ~ 60                                 | 72                                             |
| 60 ~ 70                                 | 73                                             |
| 70 ~ 80                                 | 74                                             |
| 80 ~ 90                                 | 75                                             |
| 90 ~ 100                                | 76                                             |
| 100 ~ 110                               | 77                                             |
| 110 ~ 120                               | 78                                             |
| 120 ~ 130                               | 78                                             |
| 130 ~ 140                               | 79                                             |
| 140 ~ 150                               | 80                                             |
| 150 ~ 160                               | 81                                             |
| 160 ~ 170                               | 82                                             |
| 170 ~ 180                               | 83                                             |
| 180 ~ 190                               | 84                                             |
| 190 ~ 200                               | 84                                             |
| 200 ~ 210                               | 85                                             |
| 210 ~ 220                               | 86                                             |
| 220 ~ 230                               | 87                                             |
| 230 ~ 240                               | 87                                             |
| 240 ~ 250                               | 88                                             |
| 250 ~ 260                               | 89                                             |
| 260 ~ 270                               | 89                                             |
| 270 ~ 280                               | 90                                             |
| 280 ~ 290                               | 91                                             |
| 290 ~ 300                               | 91                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 3.22 |
| Specific Gravity $d$                                     | 3.02 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 2.7                                                             | 3.0 | 3.4 | 3.5 | 3.5 | 3.7 | 3.9 | 4.5 | 4.5 | 5.1 | 5.7 | 7.1  |
| -60 ~ -40                                    | 2.7                                                             | 2.9 | 3.2 | 3.5 | 3.5 | 3.7 | 3.9 | 4.4 | 4.5 | 5.1 | 5.8 | 7.1  |
| -40 ~ -20                                    | 2.7                                                             | 2.9 | 3.3 | 3.4 | 3.5 | 3.8 | 4.0 | 4.5 | 4.6 | 5.2 | 5.9 | 7.4  |
| -20 ~ 0                                      | 2.8                                                             | 3.0 | 3.4 | 3.5 | 3.6 | 3.8 | 4.1 | 4.6 | 4.6 | 5.4 | 6.1 | 7.6  |
| 0 ~ 20                                       | 2.8                                                             | 3.1 | 3.5 | 3.8 | 3.7 | 4.0 | 4.3 | 4.8 | 4.9 | 5.6 | 6.3 | 7.9  |
| 20 ~ 40                                      | 3.0                                                             | 3.2 | 3.7 | 3.8 | 3.9 | 4.1 | 4.4 | 5.0 | 5.1 | 5.8 | 6.6 | 8.2  |
| 40 ~ 60                                      | 3.1                                                             | 3.3 | 3.9 | 4.1 | 4.1 | 4.4 | 4.7 | 5.2 | 5.3 | 6.1 | 6.9 | 8.5  |
| 60 ~ 80                                      | 3.3                                                             | 3.5 | 4.0 | 4.2 | 4.3 | 4.5 | 4.8 | 5.4 | 5.6 | 6.4 | 7.2 | 8.9  |
| 80 ~ 100                                     | 3.5                                                             | 3.7 | 4.2 | 4.4 | 4.5 | 4.8 | 5.1 | 5.7 | 5.8 | 6.6 | 7.4 | 9.3  |
| 100 ~ 120                                    | 3.6                                                             | 3.9 | 4.4 | 4.6 | 4.6 | 4.9 | 5.2 | 5.9 | 6.0 | 6.8 | 7.7 | 9.7  |
| 120 ~ 140                                    | 3.7                                                             | 4.0 | 4.5 | 4.7 | 4.8 | 5.1 | 5.4 | 6.1 | 6.2 | 7.0 | 8.0 | 10.0 |
| 140 ~ 160                                    | 3.8                                                             | 4.1 | 4.7 | 4.9 | 4.9 | 5.2 | 5.6 | 6.4 | 6.5 | 7.3 | 8.3 | 10.3 |
| 160 ~ 180                                    | 4.0                                                             | 4.3 | 4.9 | 5.1 | 5.1 | 5.5 | 5.8 | 6.5 | 6.6 | 7.5 | 8.5 | 10.5 |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.720 47<br>1.720 467 | Abbe Number $\nu_d$ | 34.71 | Dispersion $n_F - n_C$       | 0.020 758 |
| Refractive Index $n_e$ | 1.725 385             | Abbe Number $\nu_e$ | 34.47 | Dispersion $n_{F'} - n_{C'}$ | 0.021 042 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.675 34 |
| $n_{1970}$         | 1.970 09  | 1.681 98 |
| $n_{1530}$         | 1.529 58  | 1.689 41 |
| $n_{1129}$         | 1.128 64  | 1.696 65 |
| $n_t$              | 1.013 98  | 1.699 28 |
| $n_s$              | 0.852 11  | 1.704 16 |
| $n_{A'}$           | 0.768 19  | 1.707 67 |
| $n_F$              | 0.706 52  | 1.710 99 |
| $n_C$              | 0.656 27  | 1.714 37 |
| $n_{C'}$           | 0.643 85  | 1.715 32 |
| $n_{He-Ne}$        | 0.632 8   | 1.716 22 |
| $n_D$              | 0.589 29  | 1.720 29 |
| $n_d$              | 0.587 56  | 1.720 47 |
| $n_e$              | 0.546 07  | 1.725 38 |
| $n_F$              | 0.486 13  | 1.735 12 |
| $n_{F'}$           | 0.479 99  | 1.736 36 |
| $n_{He-Cd}$        | 0.441 57  | 1.745 59 |
| $n_g$              | 0.435 835 | 1.747 23 |
| $n_h$              | 0.404 656 | 1.757 77 |
| $n_i$              | 0.365 015 | 1.776 89 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.613 441 36E+00 |
| $A_2$                           | 2.572 958 88E-01 |
| $A_3$                           | 1.983 644 55E+00 |
| $B_1$                           | 1.063 867 52E-02 |
| $B_2$                           | 4.870 716 24E-02 |
| $B_3$                           | 1.597 844 04E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 101.7 |
| Rigidity Modulus G (GPa) | 40.7  |
| Poisson's Ratio $\sigma$ | 0.250 |
| Knoop Hardness Hk[Class] | 600 6 |
| Abrasion Aa              | 153   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.015 084 |
| $n_C - n_{A'}$      | 0.006 690 |
| $n_d - n_C$         | 0.006 102 |
| $n_e - n_C$         | 0.011 020 |
| $n_g - n_d$         | 0.026 767 |
| $n_g - n_F$         | 0.012 111 |
| $n_h - n_g$         | 0.010 534 |
| $n_i - n_g$         | 0.029 660 |
| $n_{C'} - n_t$      | 0.016 041 |
| $n_e - n_{C'}$      | 0.010 063 |
| $n_{F'} - n_e$      | 0.010 979 |
| $n_i - n_{F'}$      | 0.040 530 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.726 7 |
| $\theta_{C,A'}$              | 0.322 3 |
| $\theta_{d,C}$               | 0.294 0 |
| $\theta_{e,C}$               | 0.530 9 |
| $\theta_{g,d}$               | 1.289 5 |
| $\theta_{g,F}$               | 0.583 4 |
| $\theta_{h,g}$               | 0.507 5 |
| $\theta_{i,g}$               | 1.428 8 |
| $\theta'_{C,t}$              | 0.762 3 |
| $\theta'_{e,C'}$             | 0.478 2 |
| $\theta'_{F,e}$              | 0.521 8 |
| $\theta'_{i,F'}$             | 1.926 1 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.017 2  |
| $\Delta\theta_{C,A'}$ | 0.004 4  |
| $\Delta\theta_{g,d}$  | -0.003 1 |
| $\Delta\theta_{g,F}$  | -0.001 9 |
| $\Delta\theta_{i,g}$  | -0.005 6 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 390  | $\lambda_5$      | 330 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 371  | $\lambda_{0.05}$ | 331 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.38 | 1.48             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.03             |
| 340                    | 0.24             |
| 350                    | 0.49             |
| 360                    | 0.67             |
| 370                    | 0.79             |
| 380                    | 0.86             |
| 390                    | 0.908            |
| 400                    | 0.936            |
| 420                    | 0.962            |
| 440                    | 0.972            |
| 460                    | 0.979            |
| 480                    | 0.984            |
| 500                    | 0.989            |
| 550                    | 0.996            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.997            |
| 1 800                  | 0.992            |
| 2 000                  | 0.984            |
| 2 200                  | 0.955            |
| 2 400                  | 0.88             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 476  |
| Annealing Point AP (°C)                                          | 499  |
| Transformation Temperature Tg (°C)                               | 514  |
| Yield Point At (°C)                                              | 564  |
| Softening Point SP (°C)                                          | 611  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 80   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 103  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.05 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 61                                             |
| -90 ~ -80                               | 63                                             |
| -80 ~ -70                               | 65                                             |
| -70 ~ -60                               | 66                                             |
| -60 ~ -50                               | 68                                             |
| -50 ~ -40                               | 70                                             |
| -40 ~ -30                               | 71                                             |
| -30 ~ -20                               | 73                                             |
| -20 ~ -10                               | 75                                             |
| -10 ~ 0                                 | 76                                             |
| 0 ~ 10                                  | 78                                             |
| 10 ~ 20                                 | 79                                             |
| 20 ~ 30                                 | 81                                             |
| 30 ~ 40                                 | 82                                             |
| 40 ~ 50                                 | 84                                             |
| 50 ~ 60                                 | 85                                             |
| 60 ~ 70                                 | 87                                             |
| 70 ~ 80                                 | 88                                             |
| 80 ~ 90                                 | 89                                             |
| 90 ~ 100                                | 91                                             |
| 100 ~ 110                               | 92                                             |
| 110 ~ 120                               | 93                                             |
| 120 ~ 130                               | 94                                             |
| 130 ~ 140                               | 96                                             |
| 140 ~ 150                               | 97                                             |
| 150 ~ 160                               | 98                                             |
| 160 ~ 170                               | 99                                             |
| 170 ~ 180                               | 100                                            |
| 180 ~ 190                               | 102                                            |
| 190 ~ 200                               | 103                                            |
| 200 ~ 210                               | 104                                            |
| 210 ~ 220                               | 105                                            |
| 220 ~ 230                               | 106                                            |
| 230 ~ 240                               | 107                                            |
| 240 ~ 250                               | 108                                            |
| 250 ~ 260                               | 109                                            |
| 260 ~ 270                               | 109                                            |
| 270 ~ 280                               | 110                                            |
| 280 ~ 290                               | 111                                            |
| 290 ~ 300                               | 112                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.90 |
| Specific Gravity $d$                                     | 3.19 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 1.7                                                             | 2.0 | 2.4 | 2.5 | 2.6 | 2.8 | 3.2 | 3.8 | 3.9 | 4.6 | 5.6 | 7.7  |
| -60 ~ -40                                    | 1.6                                                             | 1.8 | 2.3 | 2.5 | 2.6 | 2.8 | 3.1 | 3.7 | 3.8 | 4.7 | 5.6 | 7.6  |
| -40 ~ -20                                    | 1.6                                                             | 1.9 | 2.3 | 2.5 | 2.5 | 2.8 | 3.1 | 3.8 | 3.9 | 4.7 | 5.7 | 7.8  |
| -20 ~ 0                                      | 1.6                                                             | 1.9 | 2.4 | 2.6 | 2.7 | 2.9 | 3.2 | 3.9 | 4.0 | 4.9 | 5.9 | 8.0  |
| 0 ~ 20                                       | 1.8                                                             | 2.0 | 2.5 | 2.7 | 2.7 | 3.0 | 3.3 | 4.0 | 4.1 | 5.1 | 6.0 | 8.3  |
| 20 ~ 40                                      | 1.9                                                             | 2.1 | 2.7 | 2.8 | 2.9 | 3.2 | 3.5 | 4.2 | 4.3 | 5.2 | 6.3 | 8.5  |
| 40 ~ 60                                      | 2.0                                                             | 2.2 | 2.8 | 2.9 | 3.0 | 3.3 | 3.6 | 4.3 | 4.4 | 5.5 | 6.5 | 8.8  |
| 60 ~ 80                                      | 2.0                                                             | 2.3 | 2.9 | 3.1 | 3.2 | 3.5 | 3.8 | 4.5 | 4.6 | 5.6 | 6.6 | 9.0  |
| 80 ~ 100                                     | 2.1                                                             | 2.4 | 2.9 | 3.1 | 3.2 | 3.5 | 4.0 | 4.7 | 4.8 | 5.8 | 6.9 | 9.3  |
| 100 ~ 120                                    | 2.2                                                             | 2.5 | 3.0 | 3.2 | 3.3 | 3.6 | 4.0 | 4.8 | 4.9 | 5.9 | 7.0 | 9.5  |
| 120 ~ 140                                    | 2.2                                                             | 2.5 | 3.1 | 3.3 | 3.4 | 3.8 | 4.1 | 4.9 | 5.0 | 6.1 | 7.2 | 9.7  |
| 140 ~ 160                                    | 2.2                                                             | 2.5 | 3.2 | 3.4 | 3.5 | 3.8 | 4.2 | 5.0 | 5.1 | 6.1 | 7.3 | 9.9  |
| 160 ~ 180                                    | 2.3                                                             | 2.6 | 3.2 | 3.4 | 3.5 | 3.8 | 4.2 | 5.0 | 5.1 | 6.2 | 7.4 | 10.0 |

## S-NBH51

Code(d) 750353  
Code(e) 755351

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.749 50<br>1.749 505 | Abbe Number $\nu_d$ | 35.33 | Dispersion $n_F - n_C$       | 0.021 214 |
| Refractive Index $n_e$ | 1.754 531             | Abbe Number $\nu_e$ | 35.10 | Dispersion $n_{F'} - n_{C'}$ | 0.021 498 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.702 60 |
| $n_{1970}$         | 1.970 09  | 1.709 65 |
| $n_{1530}$         | 1.529 58  | 1.717 48 |
| $n_{1129}$         | 1.128 64  | 1.725 03 |
| $n_t$              | 1.013 98  | 1.727 76 |
| $n_s$              | 0.852 11  | 1.732 79 |
| $n_{A'}$           | 0.768 19  | 1.736 40 |
| $n_F$              | 0.706 52  | 1.739 80 |
| $n_C$              | 0.656 27  | 1.743 26 |
| $n_{C'}$           | 0.643 85  | 1.744 24 |
| $n_{He-Ne}$        | 0.632 8   | 1.745 16 |
| $n_D$              | 0.589 29  | 1.749 32 |
| $n_d$              | 0.587 56  | 1.749 50 |
| $n_e$              | 0.546 07  | 1.754 53 |
| $n_F$              | 0.486 13  | 1.764 47 |
| $n_{F'}$           | 0.479 99  | 1.765 74 |
| $n_{He-Cd}$        | 0.441 57  | 1.775 15 |
| $n_g$              | 0.435 835 | 1.776 81 |
| $n_h$              | 0.404 656 | 1.787 53 |
| $n_i$              | 0.365 015 | 1.806 95 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.712 036 89E+00 |
| $A_2$                           | 2.559 895 88E-01 |
| $A_3$                           | 1.814 569 98E+00 |
| $B_1$                           | 1.077 241 34E-02 |
| $B_2$                           | 4.885 935 04E-02 |
| $B_3$                           | 1.363 590 13E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 3   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 109.7 |
| Rigidity Modulus G (GPa) | 43.8  |
| Poisson's Ratio $\sigma$ | 0.253 |
| Knoop Hardness Hk[Class] | 610 6 |
| Abrasion Aa              | 113   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.015 503 |
| $n_C - n_{A'}$      | 0.006 860 |
| $n_d - n_C$         | 0.006 246 |
| $n_e - n_C$         | 0.011 272 |
| $n_g - n_d$         | 0.027 310 |
| $n_g - n_F$         | 0.012 342 |
| $n_h - n_g$         | 0.010 718 |
| $n_i - n_g$         | 0.030 139 |
| $n_{C'} - n_t$      | 0.016 484 |
| $n_e - n_{C'}$      | 0.010 291 |
| $n_{F'} - n_e$      | 0.011 207 |
| $n_i - n_{F'}$      | 0.041 216 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.730 8 |
| $\theta_{C,A'}$              | 0.323 4 |
| $\theta_{d,C}$               | 0.294 4 |
| $\theta_{e,C}$               | 0.531 3 |
| $\theta_{g,d}$               | 1.287 4 |
| $\theta_{g,F}$               | 0.581 8 |
| $\theta_{h,g}$               | 0.505 2 |
| $\theta_{i,g}$               | 1.420 7 |
| $\theta'_{C,t}$              | 0.766 8 |
| $\theta'_{e,C'}$             | 0.478 7 |
| $\theta'_{F',e}$             | 0.521 3 |
| $\theta'_{i,F'}$             | 1.917 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.018 4  |
| $\Delta\theta_{C,A'}$ | 0.004 7  |
| $\Delta\theta_{g,d}$  | -0.003 9 |
| $\Delta\theta_{g,F}$  | -0.002 5 |
| $\Delta\theta_{i,g}$  | -0.008 5 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 400  | $\lambda_5$      | 330 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 370  | $\lambda_{0.05}$ | 331 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.22 | 1.30             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.02             |
| 340                    | 0.22             |
| 350                    | 0.49             |
| 360                    | 0.68             |
| 370                    | 0.80             |
| 380                    | 0.87             |
| 390                    | 0.918            |
| 400                    | 0.943            |
| 420                    | 0.967            |
| 440                    | 0.976            |
| 460                    | 0.982            |
| 480                    | 0.987            |
| 500                    | 0.991            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.995            |
| 1 600                  | 0.994            |
| 1 800                  | 0.989            |
| 2 000                  | 0.980            |
| 2 200                  | 0.945            |
| 2 400                  | 0.87             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 500  |
| Annealing Point AP (°C)                                          | 521  |
| Transformation Temperature Tg (°C)                               | 542  |
| Yield Point At (°C)                                              | 589  |
| Softening Point SP (°C)                                          | 631  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 73   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 93   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.12 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 53                                             |
| -90 ~ -80                               | 55                                             |
| -80 ~ -70                               | 57                                             |
| -70 ~ -60                               | 59                                             |
| -60 ~ -50                               | 61                                             |
| -50 ~ -40                               | 62                                             |
| -40 ~ -30                               | 64                                             |
| -30 ~ -20                               | 66                                             |
| -20 ~ -10                               | 67                                             |
| -10 ~ 0                                 | 69                                             |
| 0 ~ 10                                  | 70                                             |
| 10 ~ 20                                 | 72                                             |
| 20 ~ 30                                 | 73                                             |
| 30 ~ 40                                 | 75                                             |
| 40 ~ 50                                 | 76                                             |
| 50 ~ 60                                 | 77                                             |
| 60 ~ 70                                 | 79                                             |
| 70 ~ 80                                 | 80                                             |
| 80 ~ 90                                 | 81                                             |
| 90 ~ 100                                | 83                                             |
| 100 ~ 110                               | 84                                             |
| 110 ~ 120                               | 85                                             |
| 120 ~ 130                               | 86                                             |
| 130 ~ 140                               | 87                                             |
| 140 ~ 150                               | 88                                             |
| 150 ~ 160                               | 89                                             |
| 160 ~ 170                               | 90                                             |
| 170 ~ 180                               | 91                                             |
| 180 ~ 190                               | 92                                             |
| 190 ~ 200                               | 93                                             |
| 200 ~ 210                               | 94                                             |
| 210 ~ 220                               | 94                                             |
| 220 ~ 230                               | 95                                             |
| 230 ~ 240                               | 96                                             |
| 240 ~ 250                               | 97                                             |
| 250 ~ 260                               | 97                                             |
| 260 ~ 270                               | 98                                             |
| 270 ~ 280                               | 99                                             |
| 280 ~ 290                               | 99                                             |
| 290 ~ 300                               | 100                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.66 |
| Specific Gravity $d$                                     | 3.29 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 3.2                                                             | 3.4 | 4.0 | 4.1 | 4.2 | 4.4 | 4.7 | 5.3 | 5.4 | 6.2 | 7.0 | 8.8  |
| -60 ~ -40                                    | 3.0                                                             | 3.2 | 3.8 | 4.0 | 4.0 | 4.3 | 4.6 | 5.3 | 5.4 | 6.1 | 7.0 | 8.9  |
| -40 ~ -20                                    | 3.0                                                             | 3.2 | 3.9 | 4.0 | 4.1 | 4.4 | 4.7 | 5.3 | 5.4 | 6.2 | 7.2 | 9.1  |
| -20 ~ 0                                      | 3.0                                                             | 3.3 | 3.9 | 4.0 | 4.1 | 4.4 | 4.7 | 5.5 | 5.6 | 6.4 | 7.4 | 9.5  |
| 0 ~ 20                                       | 3.1                                                             | 3.3 | 3.9 | 4.1 | 4.2 | 4.5 | 4.9 | 5.6 | 5.7 | 6.6 | 7.6 | 9.8  |
| 20 ~ 40                                      | 3.2                                                             | 3.5 | 4.1 | 4.3 | 4.3 | 4.7 | 5.0 | 5.9 | 6.0 | 6.9 | 8.0 | 10.2 |
| 40 ~ 60                                      | 3.2                                                             | 3.5 | 4.2 | 4.4 | 4.4 | 4.8 | 5.3 | 6.0 | 6.1 | 7.1 | 8.2 | 10.5 |
| 60 ~ 80                                      | 3.4                                                             | 3.7 | 4.3 | 4.6 | 4.6 | 5.0 | 5.4 | 6.2 | 6.3 | 7.3 | 8.5 | 11.0 |
| 80 ~ 100                                     | 3.4                                                             | 3.7 | 4.5 | 4.7 | 4.8 | 5.2 | 5.6 | 6.4 | 6.5 | 7.6 | 8.8 | 11.3 |
| 100 ~ 120                                    | 3.4                                                             | 3.8 | 4.5 | 4.8 | 4.9 | 5.3 | 5.7 | 6.6 | 6.7 | 7.8 | 9.0 | 11.7 |
| 120 ~ 140                                    | 3.5                                                             | 3.8 | 4.7 | 4.9 | 5.0 | 5.4 | 5.8 | 6.7 | 6.9 | 8.0 | 9.3 | 12.0 |
| 140 ~ 160                                    | 3.6                                                             | 3.9 | 4.7 | 5.0 | 5.0 | 5.5 | 5.9 | 6.9 | 7.0 | 8.2 | 9.5 | 12.3 |
| 160 ~ 180                                    | 3.5                                                             | 3.9 | 4.7 | 5.0 | 5.1 | 5.5 | 6.0 | 6.9 | 7.1 | 8.3 | 9.7 | 12.6 |

## S-NBH52V

Code(d) 673383

Code(e) 677380

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.673 00<br>1.673 000 | Abbe Number $\nu_d$ | 38.26 | Dispersion $n_F - n_C$       | 0.017 592 |
| Refractive Index $n_e$ | 1.677 172             | Abbe Number $\nu_e$ | 38.01 | Dispersion $n_{F'} - n_{C'}$ | 0.017 815 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.631 49 |
| $n_{1970}$         | 1.970 09  | 1.638 15 |
| $n_{1530}$         | 1.529 58  | 1.645 44 |
| $n_{1129}$         | 1.128 64  | 1.652 25 |
| $n_t$              | 1.013 98  | 1.654 63 |
| $n_s$              | 0.852 11  | 1.658 96 |
| $n_{A'}$           | 0.768 19  | 1.662 03 |
| $n_F$              | 0.706 52  | 1.664 89 |
| $n_C$              | 0.656 27  | 1.667 79 |
| $n_{C'}$           | 0.643 85  | 1.668 61 |
| $n_{He-Ne}$        | 0.632 8   | 1.669 38 |
| $n_D$              | 0.589 29  | 1.672 85 |
| $n_d$              | 0.587 56  | 1.673 00 |
| $n_e$              | 0.546 07  | 1.677 17 |
| $n_F$              | 0.486 13  | 1.685 38 |
| $n_{F'}$           | 0.479 99  | 1.686 43 |
| $n_{He-Cd}$        | 0.441 57  | 1.694 15 |
| $n_g$              | 0.435 835 | 1.695 51 |
| $n_h$              | 0.404 656 | 1.704 25 |
| $n_i$              | 0.365 015 | 1.719 94 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.513 368 68E+00 |
| $A_2$                           | 2.123 414 78E-01 |
| $A_3$                           | 1.541 491 43E+00 |
| $B_1$                           | 9.870 778 27E-03 |
| $B_2$                           | 4.628 436 62E-02 |
| $B_3$                           | 1.269 785 10E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 96.3  |
| Rigidity Modulus G (GPa) | 38.6  |
| Poisson's Ratio $\sigma$ | 0.246 |
| Knoop Hardness Hk[Class] | 600 6 |
| Abrasion Aa              | 139   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.013 160 |
| $n_C - n_{A'}$      | 0.005 766 |
| $n_d - n_C$         | 0.005 208 |
| $n_e - n_C$         | 0.009 380 |
| $n_g - n_d$         | 0.022 512 |
| $n_g - n_F$         | 0.010 128 |
| $n_h - n_g$         | 0.008 738 |
| $n_i - n_g$         | 0.024 433 |
| $n_{C'} - n_t$      | 0.013 979 |
| $n_e - n_{C'}$      | 0.008 561 |
| $n_{F'} - n_e$      | 0.009 254 |
| $n_i - n_{F'}$      | 0.033 519 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.748 1 |
| $\theta_{C,A'}$              | 0.327 8 |
| $\theta_{d,C}$               | 0.296 0 |
| $\theta_{e,C}$               | 0.533 2 |
| $\theta_{g,d}$               | 1.279 7 |
| $\theta_{g,F}$               | 0.575 7 |
| $\theta_{h,g}$               | 0.496 7 |
| $\theta_{i,g}$               | 1.388 9 |
| $\theta'_{C,t}$              | 0.784 7 |
| $\theta'_{e,C'}$             | 0.480 6 |
| $\theta'_{F',e}$             | 0.519 4 |
| $\theta'_{i,F'}$             | 1.881 5 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.021 9  |
| $\Delta\theta_{C,A'}$ | 0.005 6  |
| $\Delta\theta_{g,d}$  | -0.005 5 |
| $\Delta\theta_{g,F}$  | -0.003 9 |
| $\Delta\theta_{i,g}$  | -0.015 8 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 360  | $\lambda_5$      | 320 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 348  | $\lambda_{0.05}$ | 320 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.25 | 0.26             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    | 0.04             |
| 330                    | 0.31             |
| 340                    | 0.65             |
| 350                    | 0.84             |
| 360                    | 0.919            |
| 370                    | 0.956            |
| 380                    | 0.974            |
| 390                    | 0.983            |
| 400                    | 0.988            |
| 420                    | 0.992            |
| 440                    | 0.993            |
| 460                    | 0.995            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.992            |
| 1 600                  | 0.993            |
| 1 800                  | 0.986            |
| 2 000                  | 0.973            |
| 2 200                  | 0.922            |
| 2 400                  | 0.82             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 460  |
| Annealing Point AP (°C)                                          | 483  |
| Transformation Temperature Tg (°C)                               | 501  |
| Yield Point At (°C)                                              | 549  |
| Softening Point SP (°C)                                          | 592  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 79   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 102  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.03 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 60                                             |
| -90 ~ -80                               | 62                                             |
| -80 ~ -70                               | 63                                             |
| -70 ~ -60                               | 65                                             |
| -60 ~ -50                               | 67                                             |
| -50 ~ -40                               | 69                                             |
| -40 ~ -30                               | 70                                             |
| -30 ~ -20                               | 72                                             |
| -20 ~ -10                               | 74                                             |
| -10 ~ 0                                 | 75                                             |
| 0 ~ 10                                  | 77                                             |
| 10 ~ 20                                 | 78                                             |
| 20 ~ 30                                 | 80                                             |
| 30 ~ 40                                 | 81                                             |
| 40 ~ 50                                 | 83                                             |
| 50 ~ 60                                 | 84                                             |
| 60 ~ 70                                 | 86                                             |
| 70 ~ 80                                 | 87                                             |
| 80 ~ 90                                 | 89                                             |
| 90 ~ 100                                | 90                                             |
| 100 ~ 110                               | 91                                             |
| 110 ~ 120                               | 93                                             |
| 120 ~ 130                               | 94                                             |
| 130 ~ 140                               | 95                                             |
| 140 ~ 150                               | 96                                             |
| 150 ~ 160                               | 97                                             |
| 160 ~ 170                               | 99                                             |
| 170 ~ 180                               | 100                                            |
| 180 ~ 190                               | 101                                            |
| 190 ~ 200                               | 102                                            |
| 200 ~ 210                               | 103                                            |
| 210 ~ 220                               | 104                                            |
| 220 ~ 230                               | 105                                            |
| 230 ~ 240                               | 106                                            |
| 240 ~ 250                               | 107                                            |
| 250 ~ 260                               | 108                                            |
| 260 ~ 270                               | 109                                            |
| 270 ~ 280                               | 110                                            |
| 280 ~ 290                               | 111                                            |
| 290 ~ 300                               | 111                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 3.11 |
| Specific Gravity $d$                                     | 3.01 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.3                                                             | 2.5 | 2.8 | 2.9 | 3.0 | 3.3 | 3.5 | 3.9 | 4.0 | 4.6 | 5.3 | 6.6 |
| -60 ~ -40                                    | 2.0                                                             | 2.2 | 2.7 | 2.8 | 2.9 | 3.1 | 3.3 | 3.8 | 3.8 | 4.5 | 5.2 | 6.6 |
| -40 ~ -20                                    | 2.0                                                             | 2.1 | 2.5 | 2.8 | 2.8 | 3.1 | 3.3 | 3.8 | 3.9 | 4.5 | 5.3 | 6.8 |
| -20 ~ 0                                      | 1.9                                                             | 2.1 | 2.6 | 2.7 | 2.8 | 3.0 | 3.3 | 3.9 | 3.9 | 4.6 | 5.4 | 7.0 |
| 0 ~ 20                                       | 1.9                                                             | 2.1 | 2.7 | 2.8 | 2.9 | 3.1 | 3.4 | 3.9 | 4.0 | 4.7 | 5.5 | 7.3 |
| 20 ~ 40                                      | 1.9                                                             | 2.2 | 2.6 | 2.8 | 2.8 | 3.2 | 3.5 | 4.1 | 4.2 | 4.9 | 5.7 | 7.4 |
| 40 ~ 60                                      | 1.9                                                             | 2.3 | 2.8 | 2.9 | 3.0 | 3.3 | 3.6 | 4.2 | 4.2 | 5.0 | 5.9 | 7.8 |
| 60 ~ 80                                      | 2.0                                                             | 2.3 | 2.8 | 3.0 | 3.0 | 3.3 | 3.6 | 4.4 | 4.4 | 5.3 | 6.1 | 8.0 |
| 80 ~ 100                                     | 2.1                                                             | 2.4 | 2.9 | 3.1 | 3.1 | 3.4 | 3.7 | 4.4 | 4.5 | 5.5 | 6.4 | 8.3 |
| 100 ~ 120                                    | 2.1                                                             | 2.4 | 2.9 | 3.1 | 3.2 | 3.5 | 3.8 | 4.5 | 4.6 | 5.5 | 6.4 | 8.6 |
| 120 ~ 140                                    | 2.1                                                             | 2.4 | 3.0 | 3.2 | 3.2 | 3.6 | 3.9 | 4.6 | 4.7 | 5.6 | 6.6 | 8.8 |
| 140 ~ 160                                    | 2.1                                                             | 2.4 | 3.1 | 3.4 | 3.4 | 3.7 | 4.1 | 4.9 | 4.9 | 5.9 | 6.9 | 9.2 |
| 160 ~ 180                                    | 2.2                                                             | 2.5 | 3.1 | 3.3 | 3.4 | 3.7 | 4.1 | 4.8 | 4.9 | 5.9 | 7.0 | 9.2 |

OHARA 25-04

## S-NBH53V

Code(d) 738323

Code(e) 743321

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.738 00<br>1.738 000 | Abbe Number $\nu_d$ | 32.33 | Dispersion $n_F - n_C$       | 0.022 830 |
| Refractive Index $n_e$ | 1.743 402             | Abbe Number $\nu_e$ | 32.10 | Dispersion $n_{F'} - n_{C'}$ | 0.023 159 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.690 06 |
| $n_{1970}$         | 1.970 09  | 1.696 88 |
| $n_{1530}$         | 1.529 58  | 1.704 57 |
| $n_{1129}$         | 1.128 64  | 1.712 18 |
| $n_t$              | 1.013 98  | 1.714 99 |
| $n_s$              | 0.852 11  | 1.720 24 |
| $n_{A'}$           | 0.768 19  | 1.724 04 |
| $n_F$              | 0.706 52  | 1.727 64 |
| $n_C$              | 0.656 27  | 1.731 32 |
| $n_{C'}$           | 0.643 85  | 1.732 37 |
| $n_{He-Ne}$        | 0.632 8   | 1.733 35 |
| $n_D$              | 0.589 29  | 1.737 80 |
| $n_d$              | 0.587 56  | 1.738 00 |
| $n_e$              | 0.546 07  | 1.743 40 |
| $n_F$              | 0.486 13  | 1.754 15 |
| $n_{F'}$           | 0.479 99  | 1.755 53 |
| $n_{He-Cd}$        | 0.441 57  | 1.765 79 |
| $n_g$              | 0.435 835 | 1.767 62 |
| $n_h$              | 0.404 656 | 1.779 43 |
| $n_i$              | 0.365 015 | 1.801 14 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.654 441 41E+00 |
| $A_2$                           | 2.674 539 27E-01 |
| $A_3$                           | 2.145 303 47E+00 |
| $B_1$                           | 1.124 855 33E-02 |
| $B_2$                           | 5.202 727 40E-02 |
| $B_3$                           | 1.673 661 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 102.7 |
| Rigidity Modulus G (GPa) | 41.5  |
| Poisson's Ratio $\sigma$ | 0.237 |
| Knoop Hardness Hk[Class] | 600 6 |
| Abrasion Aa              | 126   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.016 332 |
| $n_C - n_{A'}$      | 0.007 282 |
| $n_d - n_C$         | 0.006 678 |
| $n_e - n_C$         | 0.012 080 |
| $n_g - n_d$         | 0.029 621 |
| $n_g - n_F$         | 0.013 469 |
| $n_h - n_g$         | 0.011 812 |
| $n_i - n_g$         | 0.033 515 |
| $n_{C'} - n_t$      | 0.017 378 |
| $n_e - n_{C'}$      | 0.011 034 |
| $n_{F'} - n_e$      | 0.012 125 |
| $n_i - n_{F'}$      | 0.045 609 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.715 4 |
| $\theta_{C,A'}$              | 0.319 0 |
| $\theta_{d,C}$               | 0.292 5 |
| $\theta_{e,C}$               | 0.529 1 |
| $\theta_{g,d}$               | 1.297 5 |
| $\theta_{g,F}$               | 0.590 0 |
| $\theta_{h,g}$               | 0.517 4 |
| $\theta_{i,g}$               | 1.468 0 |
| $\theta'_{C,t}$              | 0.750 4 |
| $\theta'_{e,C'}$             | 0.476 4 |
| $\theta'_{F',e}$             | 0.523 6 |
| $\theta'_{i,F'}$             | 1.969 4 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.017 0  |
| $\Delta\theta_{C,A'}$ | 0.004 0  |
| $\Delta\theta_{g,d}$  | -0.000 1 |
| $\Delta\theta_{g,F}$  | 0.000 8  |
| $\Delta\theta_{i,g}$  | 0.013 7  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 385  | $\lambda_5$      | 330 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 361  | $\lambda_{0.05}$ | 331 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.61 | 0.67             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.03             |
| 340                    | 0.28             |
| 350                    | 0.61             |
| 360                    | 0.79             |
| 370                    | 0.88             |
| 380                    | 0.927            |
| 390                    | 0.952            |
| 400                    | 0.968            |
| 420                    | 0.982            |
| 440                    | 0.988            |
| 460                    | 0.991            |
| 480                    | 0.993            |
| 500                    | 0.995            |
| 550                    | 0.997            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.995            |
| 1 600                  | 0.995            |
| 1 800                  | 0.990            |
| 2 000                  | 0.984            |
| 2 200                  | 0.951            |
| 2 400                  | 0.928            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 501  |
| Annealing Point AP (°C)                                          | 523  |
| Transformation Temperature Tg (°C)                               | 543  |
| Yield Point At (°C)                                              | 593  |
| Softening Point SP (°C)                                          | 640  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 74   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 96   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.13 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 55                                             |
| -90 ~ -80                               | 57                                             |
| -80 ~ -70                               | 59                                             |
| -70 ~ -60                               | 61                                             |
| -60 ~ -50                               | 62                                             |
| -50 ~ -40                               | 64                                             |
| -40 ~ -30                               | 66                                             |
| -30 ~ -20                               | 67                                             |
| -20 ~ -10                               | 69                                             |
| -10 ~ 0                                 | 70                                             |
| 0 ~ 10                                  | 72                                             |
| 10 ~ 20                                 | 73                                             |
| 20 ~ 30                                 | 75                                             |
| 30 ~ 40                                 | 76                                             |
| 40 ~ 50                                 | 78                                             |
| 50 ~ 60                                 | 79                                             |
| 60 ~ 70                                 | 80                                             |
| 70 ~ 80                                 | 82                                             |
| 80 ~ 90                                 | 83                                             |
| 90 ~ 100                                | 84                                             |
| 100 ~ 110                               | 86                                             |
| 110 ~ 120                               | 87                                             |
| 120 ~ 130                               | 88                                             |
| 130 ~ 140                               | 89                                             |
| 140 ~ 150                               | 90                                             |
| 150 ~ 160                               | 91                                             |
| 160 ~ 170                               | 92                                             |
| 170 ~ 180                               | 93                                             |
| 180 ~ 190                               | 95                                             |
| 190 ~ 200                               | 96                                             |
| 200 ~ 210                               | 97                                             |
| 210 ~ 220                               | 97                                             |
| 220 ~ 230                               | 98                                             |
| 230 ~ 240                               | 99                                             |
| 240 ~ 250                               | 100                                            |
| 250 ~ 260                               | 101                                            |
| 260 ~ 270                               | 102                                            |
| 270 ~ 280                               | 103                                            |
| 280 ~ 290                               | 103                                            |
| 290 ~ 300                               | 104                                            |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 2.99 |
| Specific Gravity $d$                        | 3.19 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 2.8                                                             | 3.0 | 3.5 | 3.6 | 3.8 | 4.0 | 4.3 | 4.9 | 5.0 | 5.9 | 6.9 | 9.2  |
| -60 ~ -40                                    | 2.7                                                             | 2.9 | 3.5 | 3.7 | 3.7 | 4.0 | 4.3 | 5.1 | 5.2 | 6.0 | 7.0 | 9.5  |
| -40 ~ -20                                    | 2.8                                                             | 3.0 | 3.5 | 3.7 | 3.7 | 4.1 | 4.4 | 5.1 | 5.2 | 6.1 | 7.3 | 9.7  |
| -20 ~ 0                                      | 2.8                                                             | 3.1 | 3.7 | 3.9 | 3.9 | 4.2 | 4.5 | 5.2 | 5.3 | 6.4 | 7.4 | 10.0 |
| 0 ~ 20                                       | 3.0                                                             | 3.2 | 3.8 | 4.0 | 4.0 | 4.3 | 4.7 | 5.5 | 5.6 | 6.6 | 7.7 | 10.3 |
| 20 ~ 40                                      | 3.1                                                             | 3.3 | 3.9 | 4.1 | 4.2 | 4.5 | 4.8 | 5.6 | 5.7 | 6.8 | 8.0 | 10.7 |
| 40 ~ 60                                      | 3.1                                                             | 3.4 | 4.0 | 4.2 | 4.2 | 4.6 | 4.9 | 5.8 | 5.9 | 7.0 | 8.2 | 11.0 |
| 60 ~ 80                                      | 3.1                                                             | 3.5 | 4.1 | 4.3 | 4.4 | 4.7 | 5.1 | 5.9 | 6.0 | 7.1 | 8.4 | 11.4 |
| 80 ~ 100                                     | 3.2                                                             | 3.5 | 4.1 | 4.4 | 4.5 | 4.8 | 5.2 | 6.1 | 6.2 | 7.3 | 8.6 | 11.6 |
| 100 ~ 120                                    | 3.2                                                             | 3.5 | 4.1 | 4.3 | 4.4 | 4.8 | 5.3 | 6.1 | 6.3 | 7.4 | 8.7 | 11.8 |
| 120 ~ 140                                    | 3.1                                                             | 3.4 | 4.2 | 4.4 | 4.5 | 4.9 | 5.3 | 6.2 | 6.3 | 7.5 | 8.8 | 12.0 |
| 140 ~ 160                                    | 3.0                                                             | 3.4 | 4.1 | 4.3 | 4.4 | 4.8 | 5.2 | 6.1 | 6.2 | 7.5 | 8.8 | 12.1 |
| 160 ~ 180                                    | 2.9                                                             | 3.2 | 3.9 | 4.2 | 4.2 | 4.6 | 5.1 | 6.0 | 6.1 | 7.4 | 8.8 | 12.1 |

## S-NBH55

Code(d) 800299  
Code(e) 806296

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.800 00<br>1.800 000 | Abbe Number $\nu_d$ | 29.84 | Dispersion $n_F - n_C$       | 0.026 806 |
| Refractive Index $n_e$ | 1.806 331             | Abbe Number $\nu_e$ | 29.61 | Dispersion $n_{F'} - n_{C'}$ | 0.027 232 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.749 89 |
| $n_{1970}$         | 1.970 09  | 1.756 00 |
| $n_{1530}$         | 1.529 58  | 1.763 16 |
| $n_{1129}$         | 1.128 64  | 1.770 82 |
| $n_t$              | 1.013 98  | 1.773 81 |
| $n_s$              | 0.852 11  | 1.779 59 |
| $n_{A'}$           | 0.768 19  | 1.783 88 |
| $n_F$              | 0.706 52  | 1.787 99 |
| $n_C$              | 0.656 27  | 1.792 24 |
| $n_{C'}$           | 0.643 85  | 1.793 45 |
| $n_{He-Ne}$        | 0.632 8   | 1.794 59 |
| $n_D$              | 0.589 29  | 1.799 77 |
| $n_d$              | 0.587 56  | 1.800 00 |
| $n_e$              | 0.546 07  | 1.806 33 |
| $n_F$              | 0.486 13  | 1.819 04 |
| $n_{F'}$           | 0.479 99  | 1.820 68 |
| $n_{He-Cd}$        | 0.441 57  | 1.832 97 |
| $n_g$              | 0.435 835 | 1.835 17 |
| $n_h$              | 0.404 656 | 1.849 51 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.831 451 56E+00 |
| $A_2$                           | 2.878 180 24E-01 |
| $A_3$                           | 2.152 083 00E+00 |
| $B_1$                           | 1.224 431 39E-02 |
| $B_2$                           | 5.738 773 10E-02 |
| $B_3$                           | 1.860 991 24E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 105.3 |
| Rigidity Modulus G (GPa) | 41.5  |
| Poisson's Ratio $\sigma$ | 0.269 |
| Knoop Hardness Hk[Class] | 600 6 |
| Abrasion Aa              | 148   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.018 427 |
| $n_C - n_{A'}$      | 0.008 355 |
| $n_d - n_C$         | 0.007 763 |
| $n_e - n_C$         | 0.014 094 |
| $n_g - n_d$         | 0.035 172 |
| $n_g - n_F$         | 0.016 129 |
| $n_h - n_g$         | 0.014 338 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.019 637 |
| $n_e - n_{C'}$      | 0.012 884 |
| $n_{F'} - n_e$      | 0.014 348 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.687 4 |
| $\theta_{C,A'}$              | 0.311 7 |
| $\theta_{d,C}$               | 0.289 6 |
| $\theta_{e,C}$               | 0.525 8 |
| $\theta_{g,d}$               | 1.312 1 |
| $\theta_{g,F}$               | 0.601 7 |
| $\theta_{h,g}$               | 0.534 9 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.721 1 |
| $\theta'_{e,C'}$             | 0.473 1 |
| $\theta'_{F,e}$              | 0.526 9 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.000 7  |
| $\Delta\theta_{C,A'}$ | -0.000 3 |
| $\Delta\theta_{g,d}$  | 0.009 4  |
| $\Delta\theta_{g,F}$  | 0.008 5  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 435  | $\lambda_5$      | 360 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 392  | $\lambda_{0.05}$ | 360 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.72 | 2.91             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.04             |
| 370                    | 0.34             |
| 380                    | 0.63             |
| 390                    | 0.78             |
| 400                    | 0.86             |
| 420                    | 0.931            |
| 440                    | 0.958            |
| 460                    | 0.970            |
| 480                    | 0.978            |
| 500                    | 0.983            |
| 550                    | 0.992            |
| 600                    | 0.995            |
| 650                    | 0.995            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.991            |
| 2 000                  | 0.985            |
| 2 200                  | 0.969            |
| 2 400                  | 0.943            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 618   |
| Yield Point At (°C)                                              | 675   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 76    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 91    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.994 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 62                                             |
| -90 ~ -80                               | 63                                             |
| -80 ~ -70                               | 64                                             |
| -70 ~ -60                               | 66                                             |
| -60 ~ -50                               | 67                                             |
| -50 ~ -40                               | 68                                             |
| -40 ~ -30                               | 69                                             |
| -30 ~ -20                               | 70                                             |
| -20 ~ -10                               | 72                                             |
| -10 ~ 0                                 | 73                                             |
| 0 ~ 10                                  | 74                                             |
| 10 ~ 20                                 | 75                                             |
| 20 ~ 30                                 | 76                                             |
| 30 ~ 40                                 | 77                                             |
| 40 ~ 50                                 | 78                                             |
| 50 ~ 60                                 | 79                                             |
| 60 ~ 70                                 | 80                                             |
| 70 ~ 80                                 | 81                                             |
| 80 ~ 90                                 | 82                                             |
| 90 ~ 100                                | 83                                             |
| 100 ~ 110                               | 84                                             |
| 110 ~ 120                               | 85                                             |
| 120 ~ 130                               | 86                                             |
| 130 ~ 140                               | 87                                             |
| 140 ~ 150                               | 87                                             |
| 150 ~ 160                               | 88                                             |
| 160 ~ 170                               | 89                                             |
| 170 ~ 180                               | 90                                             |
| 180 ~ 190                               | 91                                             |
| 190 ~ 200                               | 91                                             |
| 200 ~ 210                               | 92                                             |
| 210 ~ 220                               | 93                                             |
| 220 ~ 230                               | 93                                             |
| 230 ~ 240                               | 94                                             |
| 240 ~ 250                               | 95                                             |
| 250 ~ 260                               | 95                                             |
| 260 ~ 270                               | 96                                             |
| 270 ~ 280                               | 96                                             |
| 280 ~ 290                               | 97                                             |
| 290 ~ 300                               | 97                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.50 |
| Specific Gravity $d$                                      | 3.68 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | 1.4                                                             | 1.6 | 2.3 | 2.5 | 2.5 | 2.9 | 3.2 | 4.1 | 4.3 | 5.4 | 6.8  | - |
| -60 ~ -40                                    | 1.3                                                             | 1.6 | 2.3 | 2.5 | 2.6 | 2.9 | 3.3 | 4.3 | 4.4 | 5.6 | 6.9  | - |
| -40 ~ -20                                    | 1.5                                                             | 1.7 | 2.4 | 2.6 | 2.7 | 3.1 | 3.5 | 4.4 | 4.6 | 5.8 | 7.3  | - |
| -20 ~ 0                                      | 1.5                                                             | 1.8 | 2.6 | 2.8 | 2.9 | 3.3 | 3.7 | 4.6 | 4.8 | 6.2 | 7.7  | - |
| 0 ~ 20                                       | 1.7                                                             | 2.1 | 2.8 | 3.0 | 3.1 | 3.5 | 3.9 | 4.9 | 5.0 | 6.5 | 8.1  | - |
| 20 ~ 40                                      | 1.8                                                             | 2.2 | 2.9 | 3.2 | 3.3 | 3.8 | 4.2 | 5.2 | 5.4 | 6.7 | 8.4  | - |
| 40 ~ 60                                      | 2.0                                                             | 2.3 | 3.2 | 3.4 | 3.5 | 4.0 | 4.4 | 5.5 | 5.6 | 7.1 | 8.9  | - |
| 60 ~ 80                                      | 2.1                                                             | 2.5 | 3.3 | 3.6 | 3.6 | 4.1 | 4.6 | 5.7 | 5.9 | 7.4 | 9.2  | - |
| 80 ~ 100                                     | 2.3                                                             | 2.7 | 3.5 | 3.7 | 3.8 | 4.3 | 4.8 | 5.9 | 6.1 | 7.6 | 9.5  | - |
| 100 ~ 120                                    | 2.4                                                             | 2.7 | 3.6 | 3.9 | 4.0 | 4.5 | 5.0 | 6.1 | 6.3 | 7.9 | 9.8  | - |
| 120 ~ 140                                    | 2.4                                                             | 2.8 | 3.6 | 3.9 | 4.0 | 4.6 | 5.1 | 6.3 | 6.5 | 8.1 | 10.0 | - |
| 140 ~ 160                                    | 2.4                                                             | 2.8 | 3.7 | 4.0 | 4.1 | 4.6 | 5.1 | 6.4 | 6.6 | 8.3 | 10.3 | - |
| 160 ~ 180                                    | 2.3                                                             | 2.7 | 3.6 | 3.9 | 4.0 | 4.6 | 5.1 | 6.4 | 6.7 | 8.4 | 10.5 | - |

## S-NBH56

Code(d) 855248

Code(e) 863246

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.854 78<br>1.854 780 | Abbe Number $\nu_d$ | 24.80 | Dispersion $n_F - n_C$       | 0.034 469 |
| Refractive Index $n_e$ | 1.862 904             | Abbe Number $\nu_e$ | 24.61 | Dispersion $n_{F'} - n_{C'}$ | 0.035 057 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.792 34 |
| $n_{1970}$         | 1.970 09  | 1.799 74 |
| $n_{1530}$         | 1.529 58  | 1.808 47 |
| $n_{1129}$         | 1.128 64  | 1.817 92 |
| $n_t$              | 1.013 98  | 1.821 65 |
| $n_s$              | 0.852 11  | 1.828 89 |
| $n_{A'}$           | 0.768 19  | 1.834 29 |
| $n_F$              | 0.706 52  | 1.839 49 |
| $n_C$              | 0.656 27  | 1.844 88 |
| $n_{C'}$           | 0.643 85  | 1.846 42 |
| $n_{He-Ne}$        | 0.632 8   | 1.847 87 |
| $n_D$              | 0.589 29  | 1.854 48 |
| $n_d$              | 0.587 56  | 1.854 78 |
| $n_e$              | 0.546 07  | 1.862 90 |
| $n_F$              | 0.486 13  | 1.879 35 |
| $n_{F'}$           | 0.479 99  | 1.881 47 |
| $n_{He-Cd}$        | 0.441 57  | 1.897 55 |
| $n_g$              | 0.435 835 | 1.900 45 |
| $n_h$              | 0.404 656 | 1.919 44 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.851 914 38E+00 |
| $A_2$                           | 4.311 028 52E-01 |
| $A_3$                           | 3.452 782 84E+00 |
| $B_1$                           | 1.327 326 20E-02 |
| $B_2$                           | 5.859 446 44E-02 |
| $B_3$                           | 2.393 570 89E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 3   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 106.7 |
| Rigidity Modulus G (GPa) | 42.7  |
| Poisson's Ratio $\sigma$ | 0.249 |
| Knoop Hardness Hk[Class] | 600 6 |
| Abrasion Aa              | 138   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.023 230 |
| $n_C - n_{A'}$      | 0.010 586 |
| $n_d - n_C$         | 0.009 904 |
| $n_e - n_C$         | 0.018 028 |
| $n_g - n_d$         | 0.045 668 |
| $n_g - n_F$         | 0.021 103 |
| $n_h - n_g$         | 0.018 989 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.024 770 |
| $n_e - n_{C'}$      | 0.016 488 |
| $n_{F'} - n_e$      | 0.018 569 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.673 9 |
| $\theta_{C,A'}$              | 0.307 1 |
| $\theta_{d,C}$               | 0.287 3 |
| $\theta_{e,C}$               | 0.523 0 |
| $\theta_{g,d}$               | 1.324 9 |
| $\theta_{g,F}$               | 0.612 2 |
| $\theta_{h,g}$               | 0.550 9 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.706 6 |
| $\theta'_{e,C'}$             | 0.470 3 |
| $\theta'_{F',e}$             | 0.529 7 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.010 9 |
| $\Delta\theta_{C,A'}$ | 0.001 2 |
| $\Delta\theta_{g,d}$  | 0.011 7 |
| $\Delta\theta_{g,F}$  | 0.010 9 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 360 |
| $\lambda_{70}$        | 395  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 389  | $\lambda_{0.05}$ | 358 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.57 | 2.76             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.11             |
| 370                    | 0.44             |
| 380                    | 0.69             |
| 390                    | 0.81             |
| 400                    | 0.87             |
| 420                    | 0.933            |
| 440                    | 0.958            |
| 460                    | 0.970            |
| 480                    | 0.978            |
| 500                    | 0.983            |
| 550                    | 0.993            |
| 600                    | 0.996            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.997            |
| 1 800                  | 0.993            |
| 2 000                  | 0.991            |
| 2 200                  | 0.977            |
| 2 400                  | 0.966            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | -    |
| Annealing Point AP (°C)                                          | -    |
| Transformation Temperature Tg (°C)                               | 584  |
| Yield Point At (°C)                                              | 627  |
| Softening Point SP (°C)                                          | -    |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 79   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 98   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.12 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 61                                             |
| -90 ~ -80                               | 63                                             |
| -80 ~ -70                               | 65                                             |
| -70 ~ -60                               | 66                                             |
| -60 ~ -50                               | 68                                             |
| -50 ~ -40                               | 69                                             |
| -40 ~ -30                               | 71                                             |
| -30 ~ -20                               | 72                                             |
| -20 ~ -10                               | 74                                             |
| -10 ~ 0                                 | 75                                             |
| 0 ~ 10                                  | 77                                             |
| 10 ~ 20                                 | 78                                             |
| 20 ~ 30                                 | 80                                             |
| 30 ~ 40                                 | 81                                             |
| 40 ~ 50                                 | 82                                             |
| 50 ~ 60                                 | 84                                             |
| 60 ~ 70                                 | 85                                             |
| 70 ~ 80                                 | 86                                             |
| 80 ~ 90                                 | 87                                             |
| 90 ~ 100                                | 88                                             |
| 100 ~ 110                               | 89                                             |
| 110 ~ 120                               | 91                                             |
| 120 ~ 130                               | 92                                             |
| 130 ~ 140                               | 93                                             |
| 140 ~ 150                               | 94                                             |
| 150 ~ 160                               | 95                                             |
| 160 ~ 170                               | 96                                             |
| 170 ~ 180                               | 97                                             |
| 180 ~ 190                               | 97                                             |
| 190 ~ 200                               | 98                                             |
| 200 ~ 210                               | 99                                             |
| 210 ~ 220                               | 100                                            |
| 220 ~ 230                               | 101                                            |
| 230 ~ 240                               | 101                                            |
| 240 ~ 250                               | 102                                            |
| 250 ~ 260                               | 103                                            |
| 260 ~ 270                               | 104                                            |
| 270 ~ 280                               | 104                                            |
| 280 ~ 290                               | 105                                            |
| 290 ~ 300                               | 105                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 3.35 |
| Specific Gravity $d$                                      | 3.49 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |      |      |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |      |      |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g    | h    | i |
| -80 ~ -60                                    | 1.3                                                             | 1.6 | 2.3 | 2.6 | 2.6 | 3.0 | 3.4 | 4.5 | 4.6 | 6.0  | 7.8  | - |
| -60 ~ -40                                    | 1.2                                                             | 1.5 | 2.2 | 2.5 | 2.5 | 3.0 | 3.4 | 4.5 | 4.7 | 6.2  | 8.0  | - |
| -40 ~ -20                                    | 1.0                                                             | 1.5 | 2.2 | 2.4 | 2.5 | 3.0 | 3.5 | 4.7 | 4.8 | 6.4  | 8.5  | - |
| -20 ~ 0                                      | 1.1                                                             | 1.4 | 2.2 | 2.5 | 2.6 | 3.2 | 3.7 | 4.9 | 5.0 | 6.8  | 9.0  | - |
| 0 ~ 20                                       | 1.1                                                             | 1.5 | 2.3 | 2.6 | 2.7 | 3.3 | 3.9 | 5.2 | 5.3 | 7.2  | 9.5  | - |
| 20 ~ 40                                      | 1.2                                                             | 1.6 | 2.5 | 2.8 | 2.9 | 3.5 | 4.0 | 5.5 | 5.7 | 7.6  | 10.0 | - |
| 40 ~ 60                                      | 1.3                                                             | 1.7 | 2.7 | 3.0 | 3.1 | 3.7 | 4.3 | 5.8 | 6.0 | 8.1  | 10.6 | - |
| 60 ~ 80                                      | 1.3                                                             | 1.8 | 2.8 | 3.2 | 3.2 | 3.9 | 4.6 | 6.1 | 6.3 | 8.5  | 11.1 | - |
| 80 ~ 100                                     | 1.5                                                             | 1.9 | 3.0 | 3.3 | 3.4 | 4.1 | 4.8 | 6.5 | 6.7 | 8.9  | 11.7 | - |
| 100 ~ 120                                    | 1.5                                                             | 2.0 | 3.1 | 3.5 | 3.6 | 4.3 | 5.0 | 6.7 | 6.9 | 9.3  | 12.3 | - |
| 120 ~ 140                                    | 1.6                                                             | 2.1 | 3.3 | 3.7 | 3.8 | 4.5 | 5.2 | 7.0 | 7.2 | 9.8  | 12.9 | - |
| 140 ~ 160                                    | 1.6                                                             | 2.2 | 3.4 | 3.8 | 3.9 | 4.7 | 5.4 | 7.3 | 7.5 | 10.2 | 13.4 | - |
| 160 ~ 180                                    | 1.6                                                             | 2.2 | 3.4 | 4.0 | 4.1 | 4.9 | 5.7 | 7.6 | 7.8 | 10.5 | 13.9 | - |

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## S-NBH57

Code(d) 850300  
Code(e) 857298

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.850 25<br>1.850 250 | Abbe Number $\nu_d$ | 30.05 | Dispersion $n_F - n_C$       | 0.028 299 |
| Refractive Index $n_e$ | 1.856 938             | Abbe Number $\nu_e$ | 29.82 | Dispersion $n_{F'} - n_{C'}$ | 0.028 738 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.797 33 |
| $n_{1970}$         | 1.970 09  | 1.803 74 |
| $n_{1530}$         | 1.529 58  | 1.811 27 |
| $n_{1129}$         | 1.128 64  | 1.819 35 |
| $n_t$              | 1.013 98  | 1.822 52 |
| $n_s$              | 0.852 11  | 1.828 64 |
| $n_{A'}$           | 0.768 19  | 1.833 19 |
| $n_F$              | 0.706 52  | 1.837 54 |
| $n_C$              | 0.656 27  | 1.842 04 |
| $n_{C'}$           | 0.643 85  | 1.843 32 |
| $n_{He-Ne}$        | 0.632 8   | 1.844 53 |
| $n_D$              | 0.589 29  | 1.850 00 |
| $n_d$              | 0.587 56  | 1.850 25 |
| $n_e$              | 0.546 07  | 1.856 94 |
| $n_F$              | 0.486 13  | 1.870 34 |
| $n_{F'}$           | 0.479 99  | 1.872 06 |
| $n_{He-Cd}$        | 0.441 57  | 1.884 95 |
| $n_g$              | 0.435 835 | 1.887 26 |
| $n_h$              | 0.404 656 | 1.902 20 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.920 264 88E+00 |
| $A_2$                           | 3.715 352 40E-01 |
| $A_3$                           | 2.552 057 04E+00 |
| $B_1$                           | 1.184 680 28E-02 |
| $B_2$                           | 5.321 054 72E-02 |
| $B_3$                           | 2.045 493 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 3.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 111.7 |
| Rigidity Modulus G (GPa) | 43.8  |
| Poisson's Ratio $\sigma$ | 0.275 |
| Knoop Hardness Hk[Class] | 580   |
| Abrasion Aa              | 143   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.019 520 |
| $n_C - n_{A'}$      | 0.008 849 |
| $n_d - n_C$         | 0.008 213 |
| $n_e - n_C$         | 0.014 901 |
| $n_g - n_d$         | 0.037 005 |
| $n_g - n_F$         | 0.016 919 |
| $n_h - n_g$         | 0.014 947 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.020 801 |
| $n_e - n_{C'}$      | 0.013 620 |
| $n_{F'} - n_e$      | 0.015 118 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.689 8 |
| $\theta_{C,A'}$              | 0.312 7 |
| $\theta_{d,C}$               | 0.290 2 |
| $\theta_{e,C}$               | 0.526 6 |
| $\theta_{g,d}$               | 1.307 6 |
| $\theta_{g,F}$               | 0.597 9 |
| $\theta_{h,g}$               | 0.528 2 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.723 8 |
| $\theta'_{e,C'}$             | 0.473 9 |
| $\theta'_{F,e}$              | 0.526 1 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.002 1 |
| $\Delta\theta_{C,A'}$ | 0.000 4 |
| $\Delta\theta_{g,d}$  | 0.005 3 |
| $\Delta\theta_{g,F}$  | 0.005 1 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 355 |
| $\lambda_{70}$        | 410  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 399  | $\lambda_{0.05}$ | 355 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 3.97 | 4.14             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.17             |
| 370                    | 0.42             |
| 380                    | 0.60             |
| 390                    | 0.72             |
| 400                    | 0.81             |
| 420                    | 0.89             |
| 440                    | 0.936            |
| 460                    | 0.955            |
| 480                    | 0.968            |
| 500                    | 0.978            |
| 550                    | 0.993            |
| 600                    | 0.994            |
| 650                    | 0.994            |
| 700                    | 0.996            |
| 800                    | 0.998            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.997            |
| 1 800                  | 0.992            |
| 2 000                  | 0.984            |
| 2 200                  | 0.968            |
| 2 400                  | 0.921            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 637   |
| Yield Point At (°C)                                              | 694   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 79    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 96    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.988 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 62                                             |
| -90 ~ -80                               | 64                                             |
| -80 ~ -70                               | 66                                             |
| -70 ~ -60                               | 67                                             |
| -60 ~ -50                               | 69                                             |
| -50 ~ -40                               | 70                                             |
| -40 ~ -30                               | 72                                             |
| -30 ~ -20                               | 73                                             |
| -20 ~ -10                               | 75                                             |
| -10 ~ 0                                 | 76                                             |
| 0 ~ 10                                  | 77                                             |
| 10 ~ 20                                 | 79                                             |
| 20 ~ 30                                 | 80                                             |
| 30 ~ 40                                 | 81                                             |
| 40 ~ 50                                 | 83                                             |
| 50 ~ 60                                 | 84                                             |
| 60 ~ 70                                 | 85                                             |
| 70 ~ 80                                 | 86                                             |
| 80 ~ 90                                 | 87                                             |
| 90 ~ 100                                | 88                                             |
| 100 ~ 110                               | 89                                             |
| 110 ~ 120                               | 90                                             |
| 120 ~ 130                               | 91                                             |
| 130 ~ 140                               | 92                                             |
| 140 ~ 150                               | 93                                             |
| 150 ~ 160                               | 94                                             |
| 160 ~ 170                               | 95                                             |
| 170 ~ 180                               | 95                                             |
| 180 ~ 190                               | 96                                             |
| 190 ~ 200                               | 97                                             |
| 200 ~ 210                               | 98                                             |
| 210 ~ 220                               | 98                                             |
| 220 ~ 230                               | 99                                             |
| 230 ~ 240                               | 99                                             |
| 240 ~ 250                               | 100                                            |
| 250 ~ 260                               | 100                                            |
| 260 ~ 270                               | 101                                            |
| 270 ~ 280                               | 101                                            |
| 280 ~ 290                               | 102                                            |
| 290 ~ 300                               | 102                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 1.95 |
| Specific Gravity $d$                                      | 4.00 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | 0.2                                                             | 0.4 | 1.0 | 1.2 | 1.3 | 1.6 | 2.0 | 2.8 | 3.0 | 4.0 | 5.4 | - |
| -60 ~ -40                                    | 0.1                                                             | 0.3 | 1.0 | 1.2 | 1.3 | 1.6 | 2.0 | 2.8 | 3.0 | 4.2 | 5.6 | - |
| -40 ~ -20                                    | 0.1                                                             | 0.4 | 1.1 | 1.3 | 1.3 | 1.7 | 2.1 | 3.1 | 3.2 | 4.4 | 5.8 | - |
| -20 ~ 0                                      | 0.2                                                             | 0.5 | 1.2 | 1.4 | 1.5 | 1.8 | 2.3 | 3.3 | 3.4 | 4.7 | 6.2 | - |
| 0 ~ 20                                       | 0.3                                                             | 0.6 | 1.3 | 1.5 | 1.6 | 2.1 | 2.6 | 3.5 | 3.7 | 5.0 | 6.6 | - |
| 20 ~ 40                                      | 0.5                                                             | 0.8 | 1.5 | 1.8 | 1.9 | 2.3 | 2.7 | 3.8 | 3.9 | 5.4 | 7.0 | - |
| 40 ~ 60                                      | 0.6                                                             | 1.0 | 1.7 | 2.0 | 2.1 | 2.5 | 3.0 | 4.1 | 4.3 | 5.8 | 7.5 | - |
| 60 ~ 80                                      | 0.7                                                             | 1.1 | 2.0 | 2.2 | 2.2 | 2.8 | 3.3 | 4.4 | 4.5 | 6.1 | 7.9 | - |
| 80 ~ 100                                     | 0.9                                                             | 1.2 | 2.0 | 2.3 | 2.4 | 2.9 | 3.4 | 4.7 | 4.8 | 6.4 | 8.3 | - |
| 100 ~ 120                                    | 1.0                                                             | 1.4 | 2.2 | 2.5 | 2.6 | 3.1 | 3.6 | 4.8 | 5.0 | 6.7 | 8.7 | - |
| 120 ~ 140                                    | 1.0                                                             | 1.5 | 2.3 | 2.6 | 2.7 | 3.3 | 3.8 | 5.1 | 5.2 | 6.9 | 9.0 | - |
| 140 ~ 160                                    | 1.1                                                             | 1.5 | 2.4 | 2.7 | 2.8 | 3.4 | 4.0 | 5.3 | 5.4 | 7.3 | 9.4 | - |
| 160 ~ 180                                    | 1.1                                                             | 1.5 | 2.5 | 2.8 | 3.0 | 3.6 | 4.2 | 5.5 | 5.7 | 7.5 | 9.6 | - |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.788 80<br>1.788 800 | Abbe Number $\nu_d$ | 28.43 | Dispersion $n_F - n_C$       | 0.027 747 |
| Refractive Index $n_e$ | 1.795 354             | Abbe Number $\nu_e$ | 28.22 | Dispersion $n_{F'} - n_{C'}$ | 0.028 184 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.734 59 |
| $n_{1970}$         | 1.970 09  | 1.741 70 |
| $n_{1530}$         | 1.529 58  | 1.749 87 |
| $n_{1129}$         | 1.128 64  | 1.758 29 |
| $n_t$              | 1.013 98  | 1.761 49 |
| $n_s$              | 0.852 11  | 1.767 59 |
| $n_{A'}$           | 0.768 19  | 1.772 07 |
| $n_F$              | 0.706 52  | 1.776 35 |
| $n_C$              | 0.656 27  | 1.780 76 |
| $n_{C'}$           | 0.643 85  | 1.782 01 |
| $n_{He-Ne}$        | 0.632 8   | 1.783 19 |
| $n_D$              | 0.589 29  | 1.788 56 |
| $n_d$              | 0.587 56  | 1.788 80 |
| $n_e$              | 0.546 07  | 1.795 35 |
| $n_F$              | 0.486 13  | 1.808 50 |
| $n_{F'}$           | 0.479 99  | 1.810 20 |
| $n_{He-Cd}$        | 0.441 57  | 1.822 90 |
| $n_g$              | 0.435 835 | 1.825 18 |
| $n_h$              | 0.404 656 | 1.839 97 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.714 082 19E+00 |
| $A_2$                           | 3.629 661 67E-01 |
| $A_3$                           | 2.564 862 66E+00 |
| $B_1$                           | 1.168 127 75E-02 |
| $B_2$                           | 5.408 473 47E-02 |
| $B_3$                           | 1.887 857 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 105.1 |
| Rigidity Modulus G (GPa) | 42.3  |
| Poisson's Ratio $\sigma$ | 0.244 |
| Knoop Hardness Hk[Class] | 610   |
| Abrasion Aa              | 131   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.019 265 |
| $n_C - n_{A'}$      | 0.008 684 |
| $n_d - n_C$         | 0.008 043 |
| $n_e - n_C$         | 0.014 597 |
| $n_g - n_d$         | 0.036 376 |
| $n_g - n_F$         | 0.016 672 |
| $n_h - n_g$         | 0.014 799 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.020 520 |
| $n_e - n_{C'}$      | 0.013 342 |
| $n_{F'} - n_e$      | 0.014 842 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.694 3 |
| $\theta_{C,A'}$              | 0.313 0 |
| $\theta_{d,C}$               | 0.289 9 |
| $\theta_{e,C}$               | 0.526 1 |
| $\theta_{g,d}$               | 1.311 0 |
| $\theta_{g,F}$               | 0.600 9 |
| $\theta_{h,g}$               | 0.533 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.728 1 |
| $\theta'_{e,C'}$             | 0.473 4 |
| $\theta'_{F,e}$              | 0.526 6 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.014 2 |
| $\Delta\theta_{C,A'}$ | 0.002 7 |
| $\Delta\theta_{g,d}$  | 0.005 3 |
| $\Delta\theta_{g,F}$  | 0.005 4 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 410  | $\lambda_5$      | 345 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 376  | $\lambda_{0.05}$ | 344 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.27 | 1.35             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.14             |
| 360                    | 0.48             |
| 370                    | 0.73             |
| 380                    | 0.85             |
| 390                    | 0.907            |
| 400                    | 0.936            |
| 420                    | 0.966            |
| 440                    | 0.979            |
| 460                    | 0.985            |
| 480                    | 0.989            |
| 500                    | 0.992            |
| 550                    | 0.997            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.992            |
| 2 000                  | 0.987            |
| 2 200                  | 0.965            |
| 2 400                  | 0.946            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 515  |
| Annealing Point AP (°C)                                          | 540  |
| Transformation Temperature Tg (°C)                               | 558  |
| Yield Point At (°C)                                              | 599  |
| Softening Point SP (°C)                                          | 652  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 76   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 98   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.13 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 56                                             |
| -90 ~ -80                               | 58                                             |
| -80 ~ -70                               | 60                                             |
| -70 ~ -60                               | 62                                             |
| -60 ~ -50                               | 64                                             |
| -50 ~ -40                               | 65                                             |
| -40 ~ -30                               | 67                                             |
| -30 ~ -20                               | 69                                             |
| -20 ~ -10                               | 70                                             |
| -10 ~ 0                                 | 72                                             |
| 0 ~ 10                                  | 74                                             |
| 10 ~ 20                                 | 75                                             |
| 20 ~ 30                                 | 77                                             |
| 30 ~ 40                                 | 78                                             |
| 40 ~ 50                                 | 80                                             |
| 50 ~ 60                                 | 81                                             |
| 60 ~ 70                                 | 83                                             |
| 70 ~ 80                                 | 84                                             |
| 80 ~ 90                                 | 85                                             |
| 90 ~ 100                                | 87                                             |
| 100 ~ 110                               | 88                                             |
| 110 ~ 120                               | 89                                             |
| 120 ~ 130                               | 90                                             |
| 130 ~ 140                               | 92                                             |
| 140 ~ 150                               | 93                                             |
| 150 ~ 160                               | 94                                             |
| 160 ~ 170                               | 95                                             |
| 170 ~ 180                               | 96                                             |
| 180 ~ 190                               | 97                                             |
| 190 ~ 200                               | 98                                             |
| 200 ~ 210                               | 99                                             |
| 210 ~ 220                               | 100                                            |
| 220 ~ 230                               | 101                                            |
| 230 ~ 240                               | 101                                            |
| 240 ~ 250                               | 102                                            |
| 250 ~ 260                               | 103                                            |
| 260 ~ 270                               | 104                                            |
| 270 ~ 280                               | 104                                            |
| 280 ~ 290                               | 105                                            |
| 290 ~ 300                               | 106                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 3.15 |
| Specific Gravity $d$                                     | 3.33 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | 1.9                                                             | 2.1 | 2.7 | 2.9 | 3.0 | 3.3 | 3.7 | 4.5 | 4.7 | 5.7 | 7.1  | - |
| -60 ~ -40                                    | 1.9                                                             | 2.1 | 2.8 | 3.0 | 3.1 | 3.4 | 3.8 | 4.6 | 4.7 | 6.0 | 7.3  | - |
| -40 ~ -20                                    | 1.9                                                             | 2.3 | 2.9 | 3.1 | 3.2 | 3.5 | 3.9 | 4.9 | 5.0 | 6.2 | 7.6  | - |
| -20 ~ 0                                      | 2.1                                                             | 2.4 | 3.1 | 3.3 | 3.4 | 3.8 | 4.2 | 5.1 | 5.2 | 6.5 | 8.1  | - |
| 0 ~ 20                                       | 2.2                                                             | 2.5 | 3.3 | 3.5 | 3.6 | 4.0 | 4.4 | 5.4 | 5.5 | 6.9 | 8.5  | - |
| 20 ~ 40                                      | 2.3                                                             | 2.6 | 3.3 | 3.6 | 3.8 | 4.2 | 4.6 | 5.6 | 5.8 | 7.2 | 8.8  | - |
| 40 ~ 60                                      | 2.3                                                             | 2.7 | 3.6 | 3.8 | 3.9 | 4.3 | 4.8 | 5.9 | 6.0 | 7.5 | 9.2  | - |
| 60 ~ 80                                      | 2.5                                                             | 2.8 | 3.6 | 3.9 | 4.0 | 4.4 | 4.9 | 6.0 | 6.2 | 7.8 | 9.6  | - |
| 80 ~ 100                                     | 2.5                                                             | 2.8 | 3.7 | 4.0 | 4.1 | 4.6 | 5.1 | 6.2 | 6.4 | 7.9 | 9.8  | - |
| 100 ~ 120                                    | 2.4                                                             | 2.8 | 3.7 | 4.0 | 4.1 | 4.6 | 5.2 | 6.3 | 6.5 | 8.1 | 10.0 | - |
| 120 ~ 140                                    | 2.3                                                             | 2.8 | 3.7 | 4.0 | 4.1 | 4.6 | 5.2 | 6.4 | 6.6 | 8.3 | 10.2 | - |
| 140 ~ 160                                    | 2.3                                                             | 2.7 | 3.6 | 3.9 | 4.0 | 4.6 | 5.1 | 6.4 | 6.6 | 8.3 | 10.4 | - |
| 160 ~ 180                                    | 2.1                                                             | 2.5 | 3.4 | 3.8 | 3.9 | 4.4 | 5.0 | 6.3 | 6.5 | 8.3 | 10.3 | - |

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.766 34<br>1.766 342 | Abbe Number $\nu_d$ | 35.82 | Dispersion $n_F - n_C$       | 0.021 393 |
| Refractive Index $n_e$ | 1.771 415             | Abbe Number $\nu_e$ | 35.59 | Dispersion $n_{F'} - n_{C'}$ | 0.021 677 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.720 69 |
| $n_{1970}$         | 1.970 09  | 1.727 21 |
| $n_{1530}$         | 1.529 58  | 1.734 54 |
| $n_{1129}$         | 1.128 64  | 1.741 82 |
| $n_t$              | 1.013 98  | 1.744 50 |
| $n_s$              | 0.852 11  | 1.749 51 |
| $n_{A'}$           | 0.768 19  | 1.753 13 |
| $n_F$              | 0.706 52  | 1.756 55 |
| $n_C$              | 0.656 27  | 1.760 04 |
| $n_{C'}$           | 0.643 85  | 1.761 03 |
| $n_{He-Ne}$        | 0.632 8   | 1.761 96 |
| $n_D$              | 0.589 29  | 1.766 15 |
| $n_d$              | 0.587 56  | 1.766 34 |
| $n_e$              | 0.546 07  | 1.771 41 |
| $n_F$              | 0.486 13  | 1.781 43 |
| $n_{F'}$           | 0.479 99  | 1.782 70 |
| $n_{He-Cd}$        | 0.441 57  | 1.792 15 |
| $n_g$              | 0.435 835 | 1.793 82 |
| $n_h$              | 0.404 656 | 1.804 53 |
| $n_i$              | 0.365 015 | 1.823 78 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.736 898 64E+00 |
| $A_2$                           | 2.873 625 41E-01 |
| $A_3$                           | 1.851 261 36E+00 |
| $B_1$                           | 1.078 665 06E-02 |
| $B_2$                           | 4.580 850 77E-02 |
| $B_3$                           | 1.496 469 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 3   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 112.1   |
| Rigidity Modulus G (GPa) | 44.4    |
| Poisson's Ratio $\sigma$ | 0.261   |
| Knoop Hardness Hk[Class] | 590   6 |
| Abrasion Aa              | 135     |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.015 542 |
| $n_C - n_{A'}$      | 0.006 912 |
| $n_d - n_C$         | 0.006 303 |
| $n_e - n_C$         | 0.011 376 |
| $n_g - n_d$         | 0.027 481 |
| $n_g - n_F$         | 0.012 391 |
| $n_h - n_g$         | 0.010 708 |
| $n_i - n_g$         | 0.029 960 |
| $n_{C'} - n_t$      | 0.016 531 |
| $n_e - n_{C'}$      | 0.010 387 |
| $n_{F'} - n_e$      | 0.011 290 |
| $n_i - n_{F'}$      | 0.041 078 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.726 5 |
| $\theta_{C,A'}$              | 0.323 1 |
| $\theta_{d,C}$               | 0.294 6 |
| $\theta_{e,C}$               | 0.531 8 |
| $\theta_{g,d}$               | 1.284 6 |
| $\theta_{g,F}$               | 0.579 2 |
| $\theta_{h,g}$               | 0.500 5 |
| $\theta_{i,g}$               | 1.400 5 |
| $\theta'_{C,t}$              | 0.762 6 |
| $\theta'_{e,C'}$             | 0.479 2 |
| $\theta'_{F,e}$              | 0.520 8 |
| $\theta'_{i,F'}$             | 1.895 0 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.011 8  |
| $\Delta\theta_{C,A'}$ | 0.003 8  |
| $\Delta\theta_{g,d}$  | -0.005 7 |
| $\Delta\theta_{g,F}$  | -0.004 3 |
| $\Delta\theta_{i,g}$  | -0.024 6 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 395  | $\lambda_5$      | 325 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 366  | $\lambda_{0.05}$ | 322 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.09 | 1.08             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    | 0.02             |
| 330                    | 0.17             |
| 340                    | 0.42             |
| 350                    | 0.62             |
| 360                    | 0.75             |
| 370                    | 0.84             |
| 380                    | 0.90             |
| 390                    | 0.932            |
| 400                    | 0.952            |
| 420                    | 0.970            |
| 440                    | 0.976            |
| 460                    | 0.982            |
| 480                    | 0.987            |
| 500                    | 0.991            |
| 550                    | 0.997            |
| 600                    | 0.996            |
| 650                    | 0.995            |
| 700                    | 0.997            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.995            |
| 1 800                  | 0.987            |
| 2 000                  | 0.975            |
| 2 200                  | 0.942            |
| 2 400                  | 0.87             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 493  |
| Annealing Point AP (°C)                                          | 516  |
| Transformation Temperature Tg (°C)                               | 528  |
| Yield Point At (°C)                                              | 578  |
| Softening Point SP (°C)                                          | 623  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 84   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 107  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.10 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 64                                             |
| -90 ~ -80                               | 66                                             |
| -80 ~ -70                               | 68                                             |
| -70 ~ -60                               | 69                                             |
| -60 ~ -50                               | 71                                             |
| -50 ~ -40                               | 73                                             |
| -40 ~ -30                               | 75                                             |
| -30 ~ -20                               | 76                                             |
| -20 ~ -10                               | 78                                             |
| -10 ~ 0                                 | 80                                             |
| 0 ~ 10                                  | 81                                             |
| 10 ~ 20                                 | 83                                             |
| 20 ~ 30                                 | 84                                             |
| 30 ~ 40                                 | 86                                             |
| 40 ~ 50                                 | 88                                             |
| 50 ~ 60                                 | 89                                             |
| 60 ~ 70                                 | 90                                             |
| 70 ~ 80                                 | 92                                             |
| 80 ~ 90                                 | 93                                             |
| 90 ~ 100                                | 95                                             |
| 100 ~ 110                               | 96                                             |
| 110 ~ 120                               | 97                                             |
| 120 ~ 130                               | 99                                             |
| 130 ~ 140                               | 100                                            |
| 140 ~ 150                               | 101                                            |
| 150 ~ 160                               | 102                                            |
| 160 ~ 170                               | 103                                            |
| 170 ~ 180                               | 105                                            |
| 180 ~ 190                               | 106                                            |
| 190 ~ 200                               | 107                                            |
| 200 ~ 210                               | 108                                            |
| 210 ~ 220                               | 109                                            |
| 220 ~ 230                               | 110                                            |
| 230 ~ 240                               | 111                                            |
| 240 ~ 250                               | 112                                            |
| 250 ~ 260                               | 113                                            |
| 260 ~ 270                               | 114                                            |
| 270 ~ 280                               | 115                                            |
| 280 ~ 290                               | 115                                            |
| 290 ~ 300                               | 116                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.40 |
| Specific Gravity $d$                                      | 3.47 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |      |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |      |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i    |
| -80 ~ -60                                    | 1.8                                                             | 2.2 | 2.6 | 2.8 | 2.8 | 3.1 | 3.5 | 4.0 | 4.1 | 4.8 | 5.7 | 7.4  |
| -60 ~ -40                                    | 1.7                                                             | 1.9 | 2.4 | 2.6 | 2.6 | 2.9 | 3.3 | 3.9 | 4.0 | 4.8 | 5.7 | 7.4  |
| -40 ~ -20                                    | 1.5                                                             | 1.8 | 2.4 | 2.6 | 2.6 | 2.9 | 3.2 | 3.9 | 4.0 | 4.9 | 5.7 | 7.6  |
| -20 ~ 0                                      | 1.5                                                             | 1.8 | 2.3 | 2.5 | 2.6 | 3.0 | 3.3 | 4.0 | 4.1 | 4.9 | 5.9 | 7.9  |
| 0 ~ 20                                       | 1.5                                                             | 1.8 | 2.4 | 2.7 | 2.6 | 3.0 | 3.4 | 4.1 | 4.2 | 5.1 | 6.0 | 8.1  |
| 20 ~ 40                                      | 1.5                                                             | 1.8 | 2.5 | 2.7 | 2.7 | 3.1 | 3.5 | 4.3 | 4.4 | 5.3 | 6.3 | 8.4  |
| 40 ~ 60                                      | 1.6                                                             | 1.9 | 2.5 | 2.7 | 2.8 | 3.2 | 3.6 | 4.4 | 4.5 | 5.5 | 6.5 | 8.7  |
| 60 ~ 80                                      | 1.7                                                             | 2.0 | 2.6 | 2.9 | 2.9 | 3.3 | 3.7 | 4.5 | 4.6 | 5.6 | 6.8 | 9.1  |
| 80 ~ 100                                     | 1.6                                                             | 2.0 | 2.7 | 3.0 | 3.1 | 3.4 | 3.8 | 4.7 | 4.8 | 5.8 | 7.0 | 9.3  |
| 100 ~ 120                                    | 1.7                                                             | 2.0 | 2.7 | 3.1 | 3.1 | 3.5 | 3.9 | 4.8 | 4.9 | 6.0 | 7.2 | 9.6  |
| 120 ~ 140                                    | 1.7                                                             | 2.1 | 2.9 | 3.1 | 3.2 | 3.6 | 4.0 | 4.9 | 5.0 | 6.2 | 7.4 | 9.9  |
| 140 ~ 160                                    | 1.7                                                             | 2.1 | 2.9 | 3.2 | 3.2 | 3.6 | 4.1 | 5.0 | 5.2 | 6.3 | 7.6 | 10.3 |
| 160 ~ 180                                    | 1.7                                                             | 2.1 | 2.9 | 3.1 | 3.2 | 3.7 | 4.1 | 5.1 | 5.2 | 6.4 | 7.7 | 10.5 |

S-NBM51

Code(d) 613443  
Code(e) 617440

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.613 40<br>1.613 397 | Abbe Number $\nu_d$ | 44.27 | Dispersion $n_F - n_C$       | 0.013 857 |
| Refractive Index $n_e$ | 1.616 690             | Abbe Number $\nu_e$ | 44.02 | Dispersion $n_{F'} - n_{C'}$ | 0.014 008 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.576 60 |
| $n_{1970}$         | 1.970 09  | 1.583 13 |
| $n_{1530}$         | 1.529 58  | 1.590 12 |
| $n_{1129}$         | 1.128 64  | 1.596 33 |
| $n_t$              | 1.013 98  | 1.598 41 |
| $n_s$              | 0.852 11  | 1.602 06 |
| $n_{A'}$           | 0.768 19  | 1.604 59 |
| $n_F$              | 0.706 52  | 1.606 91 |
| $n_C$              | 0.656 27  | 1.609 25 |
| $n_{C'}$           | 0.643 85  | 1.609 90 |
| $n_{He-Ne}$        | 0.632 8   | 1.610 52 |
| $n_D$              | 0.589 29  | 1.613 28 |
| $n_d$              | 0.587 56  | 1.613 40 |
| $n_e$              | 0.546 07  | 1.616 69 |
| $n_F$              | 0.486 13  | 1.623 11 |
| $n_{F'}$           | 0.479 99  | 1.623 91 |
| $n_{He-Cd}$        | 0.441 57  | 1.629 86 |
| $n_g$              | 0.435 835 | 1.630 91 |
| $n_h$              | 0.404 656 | 1.637 55 |
| $n_i$              | 0.365 015 | 1.649 27 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.370 231 01E+00 |
| $A_2$                           | 1.776 655 68E-01 |
| $A_3$                           | 1.305 154 71E+00 |
| $B_1$                           | 8.719 203 42E-03 |
| $B_2$                           | 4.057 255 52E-02 |
| $B_3$                           | 1.127 030 58E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 81.7  |
| Rigidity Modulus G (GPa) | 32.9  |
| Poisson's Ratio $\sigma$ | 0.243 |
| Knoop Hardness Hk[Class] | 560 6 |
| Abrasion Aa              | 125   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 843 |
| $n_C - n_{A'}$      | 0.004 663 |
| $n_d - n_C$         | 0.004 149 |
| $n_e - n_C$         | 0.007 442 |
| $n_g - n_d$         | 0.017 514 |
| $n_g - n_F$         | 0.007 806 |
| $n_h - n_g$         | 0.006 644 |
| $n_i - n_g$         | 0.018 359 |
| $n_{C'} - n_t$      | 0.011 500 |
| $n_e - n_{C'}$      | 0.006 785 |
| $n_{F'} - n_e$      | 0.007 223 |
| $n_i - n_{F'}$      | 0.025 357 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.782 5 |
| $\theta_{C,A'}$              | 0.336 5 |
| $\theta_{d,C}$               | 0.299 4 |
| $\theta_{e,C}$               | 0.537 1 |
| $\theta_{g,d}$               | 1.263 9 |
| $\theta_{g,F}$               | 0.563 3 |
| $\theta_{h,g}$               | 0.479 5 |
| $\theta_{i,g}$               | 1.324 9 |
| $\theta'_{C,t}$              | 0.821 0 |
| $\theta'_{e,C'}$             | 0.484 4 |
| $\theta'_{F',e}$             | 0.515 6 |
| $\theta'_{i,F'}$             | 1.810 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.028 1  |
| $\Delta\theta_{C,A'}$ | 0.007 0  |
| $\Delta\theta_{g,d}$  | -0.008 9 |
| $\Delta\theta_{g,F}$  | -0.006 5 |
| $\Delta\theta_{i,g}$  | -0.029 4 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 350  | $\lambda_5$      | 320 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 344  | $\lambda_{0.05}$ | 319 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.38 | 0.40             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    | 0.08             |
| 330                    | 0.48             |
| 340                    | 0.75             |
| 350                    | 0.87             |
| 360                    | 0.925            |
| 370                    | 0.953            |
| 380                    | 0.968            |
| 390                    | 0.978            |
| 400                    | 0.984            |
| 420                    | 0.989            |
| 440                    | 0.992            |
| 460                    | 0.993            |
| 480                    | 0.995            |
| 500                    | 0.997            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.994            |
| 1 800                  | 0.987            |
| 2 000                  | 0.972            |
| 2 200                  | 0.89             |
| 2 400                  | 0.76             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 509   |
| Annealing Point AP (°C)                                          | 531   |
| Transformation Temperature Tg (°C)                               | 559   |
| Yield Point At (°C)                                              | 620   |
| Softening Point SP (°C)                                          | 693   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 65    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 80    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.904 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 53                                             |
| -90 ~ -80                               | 54                                             |
| -80 ~ -70                               | 55                                             |
| -70 ~ -60                               | 57                                             |
| -60 ~ -50                               | 58                                             |
| -50 ~ -40                               | 59                                             |
| -40 ~ -30                               | 60                                             |
| -30 ~ -20                               | 61                                             |
| -20 ~ -10                               | 62                                             |
| -10 ~ 0                                 | 63                                             |
| 0 ~ 10                                  | 64                                             |
| 10 ~ 20                                 | 65                                             |
| 20 ~ 30                                 | 66                                             |
| 30 ~ 40                                 | 67                                             |
| 40 ~ 50                                 | 68                                             |
| 50 ~ 60                                 | 69                                             |
| 60 ~ 70                                 | 70                                             |
| 70 ~ 80                                 | 71                                             |
| 80 ~ 90                                 | 72                                             |
| 90 ~ 100                                | 73                                             |
| 100 ~ 110                               | 73                                             |
| 110 ~ 120                               | 74                                             |
| 120 ~ 130                               | 75                                             |
| 130 ~ 140                               | 76                                             |
| 140 ~ 150                               | 77                                             |
| 150 ~ 160                               | 77                                             |
| 160 ~ 170                               | 78                                             |
| 170 ~ 180                               | 79                                             |
| 180 ~ 190                               | 79                                             |
| 190 ~ 200                               | 80                                             |
| 200 ~ 210                               | 81                                             |
| 210 ~ 220                               | 81                                             |
| 220 ~ 230                               | 82                                             |
| 230 ~ 240                               | 82                                             |
| 240 ~ 250                               | 83                                             |
| 250 ~ 260                               | 84                                             |
| 260 ~ 270                               | 84                                             |
| 270 ~ 280                               | 85                                             |
| 280 ~ 290                               | 85                                             |
| 290 ~ 300                               | 85                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 3.47 |
| Specific Gravity $d$                                     | 2.93 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.2                                                             | 2.3 | 2.6 | 2.7 | 2.7 | 2.8 | 3.1 | 3.4 | 3.4 | 3.8 | 4.3 | 5.3 |
| -60 ~ -40                                    | 2.2                                                             | 2.3 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.4 | 3.4 | 3.9 | 4.4 | 5.4 |
| -40 ~ -20                                    | 2.2                                                             | 2.5 | 2.8 | 2.8 | 2.9 | 3.0 | 3.2 | 3.5 | 3.6 | 4.0 | 4.6 | 5.6 |
| -20 ~ 0                                      | 2.4                                                             | 2.5 | 2.8 | 3.0 | 3.0 | 3.2 | 3.4 | 3.7 | 3.8 | 4.2 | 4.7 | 5.8 |
| 0 ~ 20                                       | 2.6                                                             | 2.7 | 3.0 | 3.1 | 3.1 | 3.3 | 3.5 | 3.9 | 3.9 | 4.5 | 5.0 | 6.1 |
| 20 ~ 40                                      | 2.7                                                             | 2.9 | 3.2 | 3.3 | 3.3 | 3.5 | 3.7 | 4.0 | 4.1 | 4.6 | 5.2 | 6.3 |
| 40 ~ 60                                      | 2.8                                                             | 3.0 | 3.3 | 3.4 | 3.4 | 3.6 | 3.8 | 4.3 | 4.3 | 4.8 | 5.4 | 6.5 |
| 60 ~ 80                                      | 2.9                                                             | 3.1 | 3.4 | 3.5 | 3.6 | 3.8 | 3.9 | 4.4 | 4.4 | 4.9 | 5.5 | 6.8 |
| 80 ~ 100                                     | 3.0                                                             | 3.2 | 3.5 | 3.7 | 3.7 | 3.9 | 4.1 | 4.5 | 4.5 | 5.1 | 5.6 | 6.9 |
| 100 ~ 120                                    | 3.1                                                             | 3.2 | 3.6 | 3.7 | 3.7 | 3.9 | 4.1 | 4.6 | 4.6 | 5.2 | 5.8 | 7.0 |
| 120 ~ 140                                    | 3.0                                                             | 3.2 | 3.6 | 3.7 | 3.7 | 3.9 | 4.1 | 4.6 | 4.6 | 5.2 | 5.8 | 7.1 |
| 140 ~ 160                                    | 3.0                                                             | 3.2 | 3.5 | 3.7 | 3.7 | 3.9 | 4.1 | 4.6 | 4.6 | 5.2 | 5.9 | 7.2 |
| 160 ~ 180                                    | 2.9                                                             | 3.1 | 3.5 | 3.7 | 3.7 | 3.9 | 4.1 | 4.6 | 4.7 | 5.2 | 5.9 | 7.2 |

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## S-NBM52

Code(d) 622411

Code(e) 626408

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.622 05<br>1.622 050 | Abbe Number $\nu_d$ | 41.08 | Dispersion $n_F - n_C$       | 0.015 143 |
| Refractive Index $n_e$ | 1.625 645             | Abbe Number $\nu_e$ | 40.84 | Dispersion $n_{F'} - n_{C'}$ | 0.015 320 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.583 73 |
| $n_{1970}$         | 1.970 09  | 1.590 30 |
| $n_{1530}$         | 1.529 58  | 1.597 37 |
| $n_{1129}$         | 1.128 64  | 1.603 75 |
| $n_t$              | 1.013 98  | 1.605 92 |
| $n_s$              | 0.852 11  | 1.609 80 |
| $n_{A'}$           | 0.768 19  | 1.612 50 |
| $n_F$              | 0.706 52  | 1.615 01 |
| $n_C$              | 0.656 27  | 1.617 54 |
| $n_{C'}$           | 0.643 85  | 1.618 25 |
| $n_{He-Ne}$        | 0.632 8   | 1.618 92 |
| $n_D$              | 0.589 29  | 1.621 92 |
| $n_d$              | 0.587 56  | 1.622 05 |
| $n_e$              | 0.546 07  | 1.625 64 |
| $n_F$              | 0.486 13  | 1.632 68 |
| $n_{F'}$           | 0.479 99  | 1.633 57 |
| $n_{He-Cd}$        | 0.441 57  | 1.640 14 |
| $n_g$              | 0.435 835 | 1.641 30 |
| $n_h$              | 0.404 656 | 1.648 68 |
| $n_i$              | 0.365 015 | 1.661 82 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.397 992 04E+00 |
| $A_2$                           | 1.722 380 41E-01 |
| $A_3$                           | 1.217 429 91E+00 |
| $B_1$                           | 9.461 136 86E-03 |
| $B_2$                           | 4.440 777 36E-02 |
| $B_3$                           | 1.053 139 30E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 3   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 80.8  |
| Rigidity Modulus G (GPa) | 32.5  |
| Poisson's Ratio $\sigma$ | 0.243 |
| Knoop Hardness Hk[Class] | 540 5 |
| Abrasion Aa              | 120   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 617 |
| $n_C - n_{A'}$      | 0.005 036 |
| $n_d - n_C$         | 0.004 511 |
| $n_e - n_C$         | 0.008 106 |
| $n_g - n_d$         | 0.019 249 |
| $n_g - n_F$         | 0.008 617 |
| $n_h - n_g$         | 0.007 384 |
| $n_i - n_g$         | 0.020 524 |
| $n_{C'} - n_t$      | 0.012 329 |
| $n_e - n_{C'}$      | 0.007 394 |
| $n_{F'} - n_e$      | 0.007 926 |
| $n_i - n_{F'}$      | 0.028 252 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.767 2 |
| $\theta_{C,A'}$              | 0.332 6 |
| $\theta_{d,C}$               | 0.297 9 |
| $\theta_{e,C}$               | 0.535 3 |
| $\theta_{g,d}$               | 1.271 1 |
| $\theta_{g,F}$               | 0.569 0 |
| $\theta_{h,g}$               | 0.487 6 |
| $\theta_{i,g}$               | 1.355 3 |
| $\theta'_{C,t}$              | 0.804 8 |
| $\theta'_{e,C'}$             | 0.482 6 |
| $\theta'_{F',e}$             | 0.517 4 |
| $\theta'_{i,F'}$             | 1.844 1 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.027 8  |
| $\Delta\theta_{C,A'}$ | 0.007 0  |
| $\Delta\theta_{g,d}$  | -0.008 3 |
| $\Delta\theta_{g,F}$  | -0.006 0 |
| $\Delta\theta_{i,g}$  | -0.025 7 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 355  | $\lambda_5$      | 320 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 346  | $\lambda_{0.05}$ | 320 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.24 | 0.25             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    | 0.04             |
| 330                    | 0.33             |
| 340                    | 0.69             |
| 350                    | 0.86             |
| 360                    | 0.933            |
| 370                    | 0.962            |
| 380                    | 0.976            |
| 390                    | 0.984            |
| 400                    | 0.989            |
| 420                    | 0.993            |
| 440                    | 0.994            |
| 460                    | 0.996            |
| 480                    | 0.997            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.984            |
| 1 600                  | 0.991            |
| 1 800                  | 0.984            |
| 2 000                  | 0.967            |
| 2 200                  | 0.87             |
| 2 400                  | 0.75             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 541   |
| Annealing Point AP (°C)                                          | 568   |
| Transformation Temperature Tg (°C)                               | 584   |
| Yield Point At (°C)                                              | 645   |
| Softening Point SP (°C)                                          | 701   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 74    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 87    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.957 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 61                                             |
| -90 ~ -80                               | 62                                             |
| -80 ~ -70                               | 64                                             |
| -70 ~ -60                               | 65                                             |
| -60 ~ -50                               | 66                                             |
| -50 ~ -40                               | 67                                             |
| -40 ~ -30                               | 68                                             |
| -30 ~ -20                               | 69                                             |
| -20 ~ -10                               | 71                                             |
| -10 ~ 0                                 | 72                                             |
| 0 ~ 10                                  | 73                                             |
| 10 ~ 20                                 | 74                                             |
| 20 ~ 30                                 | 75                                             |
| 30 ~ 40                                 | 76                                             |
| 40 ~ 50                                 | 76                                             |
| 50 ~ 60                                 | 77                                             |
| 60 ~ 70                                 | 78                                             |
| 70 ~ 80                                 | 79                                             |
| 80 ~ 90                                 | 80                                             |
| 90 ~ 100                                | 81                                             |
| 100 ~ 110                               | 81                                             |
| 110 ~ 120                               | 82                                             |
| 120 ~ 130                               | 83                                             |
| 130 ~ 140                               | 83                                             |
| 140 ~ 150                               | 84                                             |
| 150 ~ 160                               | 85                                             |
| 160 ~ 170                               | 85                                             |
| 170 ~ 180                               | 86                                             |
| 180 ~ 190                               | 86                                             |
| 190 ~ 200                               | 87                                             |
| 200 ~ 210                               | 87                                             |
| 210 ~ 220                               | 88                                             |
| 220 ~ 230                               | 88                                             |
| 230 ~ 240                               | 88                                             |
| 240 ~ 250                               | 89                                             |
| 250 ~ 260                               | 89                                             |
| 260 ~ 270                               | 89                                             |
| 270 ~ 280                               | 90                                             |
| 280 ~ 290                               | 90                                             |
| 290 ~ 300                               | 90                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 3.62 |
| Specific Gravity $d$                                     | 2.86 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.9                                                             | 2.1 | 2.4 | 2.5 | 2.5 | 2.8 | 2.9 | 3.3 | 3.4 | 3.9 | 4.5 | 5.7 |
| -60 ~ -40                                    | 1.7                                                             | 2.0 | 2.3 | 2.4 | 2.5 | 2.6 | 2.8 | 3.3 | 3.4 | 3.9 | 4.4 | 5.6 |
| -40 ~ -20                                    | 1.7                                                             | 2.0 | 2.3 | 2.4 | 2.5 | 2.7 | 2.9 | 3.3 | 3.3 | 4.0 | 4.5 | 5.8 |
| -20 ~ 0                                      | 1.8                                                             | 2.0 | 2.4 | 2.5 | 2.6 | 2.8 | 3.0 | 3.4 | 3.5 | 4.0 | 4.6 | 6.0 |
| 0 ~ 20                                       | 2.0                                                             | 2.1 | 2.5 | 2.6 | 2.6 | 2.9 | 3.1 | 3.5 | 3.6 | 4.3 | 4.9 | 6.2 |
| 20 ~ 40                                      | 2.1                                                             | 2.3 | 2.6 | 2.8 | 2.8 | 3.0 | 3.2 | 3.7 | 3.8 | 4.5 | 5.1 | 6.5 |
| 40 ~ 60                                      | 2.2                                                             | 2.4 | 2.8 | 2.9 | 2.9 | 3.2 | 3.5 | 4.0 | 4.0 | 4.6 | 5.3 | 6.7 |
| 60 ~ 80                                      | 2.4                                                             | 2.5 | 3.0 | 3.1 | 3.1 | 3.4 | 3.6 | 4.1 | 4.2 | 4.8 | 5.5 | 7.1 |
| 80 ~ 100                                     | 2.5                                                             | 2.7 | 3.1 | 3.3 | 3.3 | 3.5 | 3.8 | 4.3 | 4.4 | 5.0 | 5.7 | 7.2 |
| 100 ~ 120                                    | 2.6                                                             | 2.8 | 3.3 | 3.4 | 3.5 | 3.7 | 4.0 | 4.5 | 4.6 | 5.2 | 6.0 | 7.5 |
| 120 ~ 140                                    | 2.7                                                             | 3.0 | 3.4 | 3.5 | 3.6 | 3.8 | 4.1 | 4.6 | 4.7 | 5.4 | 6.1 | 7.7 |
| 140 ~ 160                                    | 2.8                                                             | 3.0 | 3.5 | 3.7 | 3.7 | 4.0 | 4.2 | 4.8 | 4.9 | 5.6 | 6.4 | 8.1 |
| 160 ~ 180                                    | 2.9                                                             | 3.2 | 3.7 | 3.8 | 3.9 | 4.1 | 4.4 | 5.0 | 5.1 | 5.8 | 6.6 | 8.3 |

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## S-NPH 1

Code(d) 808228

Code(e) 816226

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.808 09<br>1.808 095 | Abbe Number $\nu_d$ | 22.76 | Dispersion $n_F - n_C$       | 0.035 504 |
| Refractive Index $n_e$ | 1.816 434             | Abbe Number $\nu_e$ | 22.57 | Dispersion $n_{F'} - n_{C'}$ | 0.036 174 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.744 55 |
| $n_{1970}$         | 1.970 09  | 1.752 26 |
| $n_{1530}$         | 1.529 58  | 1.761 25 |
| $n_{1129}$         | 1.128 64  | 1.770 84 |
| $n_t$              | 1.013 98  | 1.774 59 |
| $n_s$              | 0.852 11  | 1.781 87 |
| $n_{A'}$           | 0.768 19  | 1.787 31 |
| $n_F$              | 0.706 52  | 1.792 56 |
| $n_C$              | 0.656 27  | 1.798 01 |
| $n_{C'}$           | 0.643 85  | 1.799 57 |
| $n_{\text{He-Ne}}$ | 0.632 8   | 1.801 05 |
| $n_D$              | 0.589 29  | 1.807 79 |
| $n_d$              | 0.587 56  | 1.808 09 |
| $n_e$              | 0.546 07  | 1.816 43 |
| $n_F$              | 0.486 13  | 1.833 51 |
| $n_{F'}$           | 0.479 99  | 1.835 75 |
| $n_{\text{He-Cd}}$ | 0.441 57  | 1.852 79 |
| $n_g$              | 0.435 835 | 1.855 90 |
| $n_h$              | 0.404 656 | 1.876 58 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.751 566 23E+00 |
| $A_2$                           | 3.640 063 04E-01 |
| $A_3$                           | 2.478 741 41E+00 |
| $B_1$                           | 1.350 046 81E-02 |
| $B_2$                           | 6.682 451 47E-02 |
| $B_3$                           | 1.707 560 06E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 89.3  |
| Rigidity Modulus G (GPa) | 35.7  |
| Poisson's Ratio $\sigma$ | 0.250 |
| Knoop Hardness Hk[Class] | 470 5 |
| Abrasion Aa              | 320   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.023 420 |
| $n_C - n_{A'}$      | 0.010 701 |
| $n_d - n_C$         | 0.010 086 |
| $n_e - n_C$         | 0.018 425 |
| $n_g - n_d$         | 0.047 809 |
| $n_g - n_F$         | 0.022 391 |
| $n_h - n_g$         | 0.020 676 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.024 983 |
| $n_e - n_{C'}$      | 0.016 862 |
| $n_{F'} - n_e$      | 0.019 312 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.659 6 |
| $\theta_{C,A'}$              | 0.301 4 |
| $\theta_{d,C}$               | 0.284 1 |
| $\theta_{e,C}$               | 0.519 0 |
| $\theta_{g,d}$               | 1.346 6 |
| $\theta_{g,F}$               | 0.630 7 |
| $\theta_{h,g}$               | 0.582 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.690 6 |
| $\theta'_{e,C'}$             | 0.466 1 |
| $\theta'_{F',e}$             | 0.533 9 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.006 1  |
| $\Delta\theta_{C,A'}$ | -0.002 0 |
| $\Delta\theta_{g,d}$  | 0.029 2  |
| $\Delta\theta_{g,F}$  | 0.026 1  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 445  | $\lambda_5$      | 375 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 404  | $\lambda_{0.05}$ | 378 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 4.24 | 4.43             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    |                  |
| 380                    | 0.14             |
| 390                    | 0.53             |
| 400                    | 0.77             |
| 420                    | 0.917            |
| 440                    | 0.952            |
| 460                    | 0.967            |
| 480                    | 0.975            |
| 500                    | 0.982            |
| 550                    | 0.992            |
| 600                    | 0.994            |
| 650                    | 0.995            |
| 700                    | 0.996            |
| 800                    | 0.997            |
| 900                    | 0.997            |
| 1 000                  | 0.996            |
| 1 200                  | 0.997            |
| 1 400                  | 0.994            |
| 1 600                  | 0.992            |
| 1 800                  | 0.984            |
| 2 000                  | 0.973            |
| 2 200                  | 0.934            |
| 2 400                  | 0.88             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 516   |
| Annealing Point AP (°C)                                          | 547   |
| Transformation Temperature Tg (°C)                               | 556   |
| Yield Point At (°C)                                              | 604   |
| Softening Point SP (°C)                                          | 645   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 84    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 106   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.882 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 66                                             |
| -90 ~ -80                               | 68                                             |
| -80 ~ -70                               | 70                                             |
| -70 ~ -60                               | 71                                             |
| -60 ~ -50                               | 73                                             |
| -50 ~ -40                               | 75                                             |
| -40 ~ -30                               | 76                                             |
| -30 ~ -20                               | 78                                             |
| -20 ~ -10                               | 80                                             |
| -10 ~ 0                                 | 81                                             |
| 0 ~ 10                                  | 83                                             |
| 10 ~ 20                                 | 84                                             |
| 20 ~ 30                                 | 86                                             |
| 30 ~ 40                                 | 87                                             |
| 40 ~ 50                                 | 89                                             |
| 50 ~ 60                                 | 90                                             |
| 60 ~ 70                                 | 91                                             |
| 70 ~ 80                                 | 93                                             |
| 80 ~ 90                                 | 94                                             |
| 90 ~ 100                                | 95                                             |
| 100 ~ 110                               | 96                                             |
| 110 ~ 120                               | 97                                             |
| 120 ~ 130                               | 99                                             |
| 130 ~ 140                               | 100                                            |
| 140 ~ 150                               | 101                                            |
| 150 ~ 160                               | 102                                            |
| 160 ~ 170                               | 103                                            |
| 170 ~ 180                               | 104                                            |
| 180 ~ 190                               | 105                                            |
| 190 ~ 200                               | 106                                            |
| 200 ~ 210                               | 107                                            |
| 210 ~ 220                               | 108                                            |
| 220 ~ 230                               | 109                                            |
| 230 ~ 240                               | 109                                            |
| 240 ~ 250                               | 110                                            |
| 250 ~ 260                               | 111                                            |
| 260 ~ 270                               | 112                                            |
| 270 ~ 280                               | 112                                            |
| 280 ~ 290                               | 113                                            |
| 290 ~ 300                               | 114                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 3.23 |
| Specific Gravity $d$                                     | 3.29 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                        |      |      |      |      |      |      |      |      |     |     |   |
|----------------------------------------------|------------------------------------------------------------------------|------|------|------|------|------|------|------|------|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{\text{rel}} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |     |     |   |
|                                              | 1550                                                                   | t    | r    | C    | C'   | d    | e    | F    | F'   | g   | h   | i |
| -80 ~ -60                                    | -3.0                                                                   | -2.9 | -2.3 | -2.1 | -2.0 | -1.7 | -1.3 | -0.2 | -0.1 | 1.6 | 3.8 | - |
| -60 ~ -40                                    | -3.1                                                                   | -2.9 | -2.3 | -2.1 | -2.0 | -1.6 | -1.2 | -0.1 | 0.1  | 1.8 | 4.2 | - |
| -40 ~ -20                                    | -3.1                                                                   | -2.9 | -2.3 | -2.1 | -2.0 | -1.5 | -1.0 | 0.1  | 0.3  | 2.2 | 4.7 | - |
| -20 ~ 0                                      | -3.1                                                                   | -2.8 | -2.1 | -1.9 | -1.8 | -1.3 | -0.9 | 0.3  | 0.5  | 2.5 | 5.2 | - |
| 0 ~ 20                                       | -3.1                                                                   | -2.7 | -2.0 | -1.7 | -1.7 | -1.2 | -0.7 | 0.6  | 0.8  | 2.9 | 5.7 | - |
| 20 ~ 40                                      | -2.9                                                                   | -2.6 | -1.9 | -1.5 | -1.5 | -1.0 | -0.4 | 0.9  | 1.1  | 3.3 | 6.3 | - |
| 40 ~ 60                                      | -2.8                                                                   | -2.5 | -1.7 | -1.4 | -1.3 | -0.8 | -0.2 | 1.2  | 1.4  | 3.7 | 6.9 | - |
| 60 ~ 80                                      | -2.8                                                                   | -2.4 | -1.6 | -1.3 | -1.2 | -0.7 | -0.1 | 1.5  | 1.7  | 4.1 | 7.4 | - |
| 80 ~ 100                                     | -2.7                                                                   | -2.3 | -1.5 | -1.2 | -1.1 | -0.5 | 0.2  | 1.7  | 1.9  | 4.5 | 7.9 | - |
| 100 ~ 120                                    | -2.7                                                                   | -2.3 | -1.4 | -1.1 | -1.0 | -0.4 | 0.3  | 1.9  | 2.2  | 4.7 | 8.3 | - |
| 120 ~ 140                                    | -2.7                                                                   | -2.3 | -1.4 | -1.0 | -0.9 | -0.3 | 0.4  | 2.1  | 2.3  | 5.0 | 8.7 | - |
| 140 ~ 160                                    | -2.8                                                                   | -2.4 | -1.4 | -1.0 | -0.9 | -0.2 | 0.5  | 2.2  | 2.5  | 5.3 | 9.2 | - |
| 160 ~ 180                                    | -2.9                                                                   | -2.5 | -1.4 | -1.1 | -0.9 | -0.3 | 0.5  | 2.4  | 2.7  | 5.6 | 9.5 | - |

OHARA 25-04

## S-NPH 1W

Code(d) **808228**  
Code(e) **816226**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.808 09</b><br>1.808 095 | Abbe Number $\nu_d$ | <b>22.76</b> | Dispersion $n_F - n_C$       | <b>0.035 504</b> |
| Refractive Index $n_e$ | 1.816 434                    | Abbe Number $\nu_e$ | 22.57        | Dispersion $n_{F'} - n_{C'}$ | 0.036 174        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.744 55 |
| $n_{1970}$         | 1.970 09  | 1.752 26 |
| $n_{1530}$         | 1.529 58  | 1.761 25 |
| $n_{1129}$         | 1.128 64  | 1.770 84 |
| $n_t$              | 1.013 98  | 1.774 59 |
| $n_s$              | 0.852 11  | 1.781 87 |
| $n_{A'}$           | 0.768 19  | 1.787 31 |
| $n_F$              | 0.706 52  | 1.792 56 |
| $n_C$              | 0.656 27  | 1.798 01 |
| $n_{C'}$           | 0.643 85  | 1.799 57 |
| $n_{\text{He-Ne}}$ | 0.632 8   | 1.801 05 |
| $n_D$              | 0.589 29  | 1.807 79 |
| $n_d$              | 0.587 56  | 1.808 09 |
| $n_e$              | 0.546 07  | 1.816 43 |
| $n_F$              | 0.486 13  | 1.833 51 |
| $n_{F'}$           | 0.479 99  | 1.835 75 |
| $n_{\text{He-Cd}}$ | 0.441 57  | 1.852 79 |
| $n_g$              | 0.435 835 | 1.855 90 |
| $n_h$              | 0.404 656 | 1.876 58 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.751 566 23E+00 |
| $A_2$                           | 3.640 063 04E-01 |
| $A_3$                           | 2.478 741 41E+00 |
| $B_1$                           | 1.350 046 81E-02 |
| $B_2$                           | 6.682 451 47E-02 |
| $B_3$                           | 1.707 560 06E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 89.3    |
| Rigidity Modulus G (GPa) | 35.7    |
| Poisson's Ratio $\sigma$ | 0.250   |
| Knoop Hardness Hk[Class] | 460   5 |
| Abrasion Aa              | 320     |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.023 420 |
| $n_C - n_{A'}$      | 0.010 701 |
| $n_d - n_C$         | 0.010 086 |
| $n_e - n_C$         | 0.018 425 |
| $n_g - n_d$         | 0.047 809 |
| $n_g - n_F$         | 0.022 391 |
| $n_h - n_g$         | 0.020 676 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.024 983 |
| $n_e - n_{C'}$      | 0.016 862 |
| $n_{F'} - n_e$      | 0.019 312 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.659 6 |
| $\theta_{C,A'}$              | 0.301 4 |
| $\theta_{d,C}$               | 0.284 1 |
| $\theta_{e,C}$               | 0.519 0 |
| $\theta_{g,d}$               | 1.346 6 |
| $\theta_{g,F}$               | 0.630 7 |
| $\theta_{h,g}$               | 0.582 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.690 6 |
| $\theta'_{e,C'}$             | 0.466 1 |
| $\theta'_{F',e}$             | 0.533 9 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.006 1  |
| $\Delta\theta_{C,A'}$ | -0.002 0 |
| $\Delta\theta_{g,d}$  | 0.029 2  |
| $\Delta\theta_{g,F}$  | 0.026 1  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 420  | $\lambda_5$      | 375 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 395  | $\lambda_{0.05}$ | 372 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.65 | 2.84             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    |                  |
| 380                    | 0.28             |
| 390                    | 0.67             |
| 400                    | 0.87             |
| 420                    | 0.956            |
| 440                    | 0.972            |
| 460                    | 0.978            |
| 480                    | 0.983            |
| 500                    | 0.986            |
| 550                    | 0.993            |
| 600                    | 0.996            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.996            |
| 1 600                  | 0.994            |
| 1 800                  | 0.986            |
| 2 000                  | 0.973            |
| 2 200                  | 0.932            |
| 2 400                  | 0.88             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 516   |
| Annealing Point AP (°C)                                          | 547   |
| Transformation Temperature Tg (°C)                               | 556   |
| Yield Point At (°C)                                              | 604   |
| Softening Point SP (°C)                                          | 645   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 84    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 106   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.882 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 66                                             |
| -90 ~ -80                               | 68                                             |
| -80 ~ -70                               | 70                                             |
| -70 ~ -60                               | 71                                             |
| -60 ~ -50                               | 73                                             |
| -50 ~ -40                               | 75                                             |
| -40 ~ -30                               | 76                                             |
| -30 ~ -20                               | 78                                             |
| -20 ~ -10                               | 80                                             |
| -10 ~ 0                                 | 81                                             |
| 0 ~ 10                                  | 83                                             |
| 10 ~ 20                                 | 84                                             |
| 20 ~ 30                                 | 86                                             |
| 30 ~ 40                                 | 87                                             |
| 40 ~ 50                                 | 89                                             |
| 50 ~ 60                                 | 90                                             |
| 60 ~ 70                                 | 91                                             |
| 70 ~ 80                                 | 93                                             |
| 80 ~ 90                                 | 94                                             |
| 90 ~ 100                                | 95                                             |
| 100 ~ 110                               | 96                                             |
| 110 ~ 120                               | 97                                             |
| 120 ~ 130                               | 99                                             |
| 130 ~ 140                               | 100                                            |
| 140 ~ 150                               | 101                                            |
| 150 ~ 160                               | 102                                            |
| 160 ~ 170                               | 103                                            |
| 170 ~ 180                               | 104                                            |
| 180 ~ 190                               | 105                                            |
| 190 ~ 200                               | 106                                            |
| 200 ~ 210                               | 107                                            |
| 210 ~ 220                               | 108                                            |
| 220 ~ 230                               | 109                                            |
| 230 ~ 240                               | 109                                            |
| 240 ~ 250                               | 110                                            |
| 250 ~ 260                               | 111                                            |
| 260 ~ 270                               | 112                                            |
| 270 ~ 280                               | 112                                            |
| 280 ~ 290                               | 113                                            |
| 290 ~ 300                               | 114                                            |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 3.23 |
| Specific Gravity $d$                        | 3.29 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                        |      |      |      |      |      |      |      |      |     |     |   |
|----------------------------------------------|------------------------------------------------------------------------|------|------|------|------|------|------|------|------|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{\text{rel}} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |     |     |   |
|                                              | 1550                                                                   | t    | r    | C    | C'   | d    | e    | F    | F'   | g   | h   | i |
| -80 ~ -60                                    | -3.0                                                                   | -2.9 | -2.3 | -2.1 | -2.0 | -1.7 | -1.3 | -0.2 | -0.1 | 1.6 | 3.8 | - |
| -60 ~ -40                                    | -3.1                                                                   | -2.9 | -2.3 | -2.1 | -2.0 | -1.6 | -1.2 | -0.1 | 0.1  | 1.8 | 4.2 | - |
| -40 ~ -20                                    | -3.1                                                                   | -2.9 | -2.3 | -2.1 | -2.0 | -1.5 | -1.0 | 0.1  | 0.3  | 2.2 | 4.7 | - |
| -20 ~ 0                                      | -3.1                                                                   | -2.8 | -2.1 | -1.9 | -1.8 | -1.3 | -0.9 | 0.3  | 0.5  | 2.5 | 5.2 | - |
| 0 ~ 20                                       | -3.1                                                                   | -2.7 | -2.0 | -1.7 | -1.7 | -1.2 | -0.7 | 0.6  | 0.8  | 2.9 | 5.7 | - |
| 20 ~ 40                                      | -2.9                                                                   | -2.6 | -1.9 | -1.5 | -1.5 | -1.0 | -0.4 | 0.9  | 1.1  | 3.3 | 6.3 | - |
| 40 ~ 60                                      | -2.8                                                                   | -2.5 | -1.7 | -1.4 | -1.3 | -0.8 | -0.2 | 1.2  | 1.4  | 3.7 | 6.9 | - |
| 60 ~ 80                                      | -2.8                                                                   | -2.4 | -1.6 | -1.3 | -1.2 | -0.7 | -0.1 | 1.5  | 1.7  | 4.1 | 7.4 | - |
| 80 ~ 100                                     | -2.7                                                                   | -2.3 | -1.5 | -1.2 | -1.1 | -0.5 | 0.2  | 1.7  | 1.9  | 4.5 | 7.9 | - |
| 100 ~ 120                                    | -2.7                                                                   | -2.3 | -1.4 | -1.1 | -1.0 | -0.4 | 0.3  | 1.9  | 2.2  | 4.7 | 8.3 | - |
| 120 ~ 140                                    | -2.7                                                                   | -2.3 | -1.4 | -1.0 | -0.9 | -0.3 | 0.4  | 2.1  | 2.3  | 5.0 | 8.7 | - |
| 140 ~ 160                                    | -2.8                                                                   | -2.4 | -1.4 | -1.0 | -0.9 | -0.2 | 0.5  | 2.2  | 2.5  | 5.3 | 9.2 | - |
| 160 ~ 180                                    | -2.9                                                                   | -2.5 | -1.4 | -1.1 | -0.9 | -0.3 | 0.5  | 2.4  | 2.7  | 5.6 | 9.5 | - |

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S-NPH 2

Code(d) 923189  
Code(e) 934187

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.922 86<br>1.922 860 | Abbe Number $\nu_d$ | 18.90 | Dispersion $n_F - n_C$       | 0.048 838 |
| Refractive Index $n_e$ | 1.934 291             | Abbe Number $\nu_e$ | 18.74 | Dispersion $n_{F'} - n_{C'}$ | 0.049 853 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.842 14 |
| $n_{1970}$         | 1.970 09  | 1.850 93 |
| $n_{1530}$         | 1.529 58  | 1.861 46 |
| $n_{1129}$         | 1.128 64  | 1.873 27 |
| $n_t$              | 1.013 98  | 1.878 07 |
| $n_s$              | 0.852 11  | 1.887 58 |
| $n_{A'}$           | 0.768 19  | 1.894 79 |
| $n_F$              | 0.706 52  | 1.901 81 |
| $n_C$              | 0.656 27  | 1.909 16 |
| $n_{C'}$           | 0.643 85  | 1.911 27 |
| $n_{He-Ne}$        | 0.632 8   | 1.913 27 |
| $n_D$              | 0.589 29  | 1.922 45 |
| $n_d$              | 0.587 56  | 1.922 86 |
| $n_e$              | 0.546 07  | 1.934 29 |
| $n_F$              | 0.486 13  | 1.958 00 |
| $n_{F'}$           | 0.479 99  | 1.961 12 |
| $n_{He-Cd}$        | 0.441 57  | 1.985 26 |
| $n_g$              | 0.435 835 | 1.989 72 |
| $n_h$              | 0.404 656 | 2.019 76 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.038 695 10E+00 |
| $A_2$                           | 4.372 696 41E-01 |
| $A_3$                           | 2.967 114 61E+00 |
| $B_1$                           | 1.707 962 24E-02 |
| $B_2$                           | 7.492 548 13E-02 |
| $B_3$                           | 1.741 553 54E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 99.1  |
| Rigidity Modulus G (GPa) | 39.7  |
| Poisson's Ratio $\sigma$ | 0.249 |
| Knoop Hardness Hk[Class] | 470   |
| Abrasion Aa              | 237   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.031 086 |
| $n_C - n_{A'}$      | 0.014 367 |
| $n_d - n_C$         | 0.013 702 |
| $n_e - n_C$         | 0.025 133 |
| $n_g - n_d$         | 0.066 857 |
| $n_g - n_F$         | 0.031 721 |
| $n_h - n_g$         | 0.030 046 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.033 200 |
| $n_e - n_{C'}$      | 0.023 019 |
| $n_{F'} - n_e$      | 0.026 834 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.636 5 |
| $\theta_{C,A'}$              | 0.294 2 |
| $\theta_{d,C}$               | 0.280 6 |
| $\theta_{e,C}$               | 0.514 6 |
| $\theta_{g,d}$               | 1.369 0 |
| $\theta_{g,F}$               | 0.649 5 |
| $\theta_{h,g}$               | 0.615 2 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.666 0 |
| $\theta'_{e,C'}$             | 0.461 7 |
| $\theta'_{F,e}$              | 0.538 3 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.001 2  |
| $\Delta\theta_{C,A'}$ | -0.004 5 |
| $\Delta\theta_{g,d}$  | 0.043 6  |
| $\Delta\theta_{g,F}$  | 0.038 6  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |       |                  |     |
|-----------------------|-------|------------------|-----|
| $\lambda_{80}$        |       | $\lambda_5$      | 390 |
| $\lambda_{70}$        | 440   |                  |     |
|                       |       |                  |     |
| Internal transmission |       |                  |     |
| $\lambda_{0.80}$      | 433   | $\lambda_{0.05}$ | 391 |
|                       |       |                  |     |
| CCI                   |       |                  |     |
| B                     | G     | R                |     |
| 0.00                  | 12.87 | 13.51            |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    |                  |
| 380                    |                  |
| 390                    | 0.02             |
| 400                    | 0.24             |
| 420                    | 0.70             |
| 440                    | 0.85             |
| 460                    | 0.910            |
| 480                    | 0.936            |
| 500                    | 0.953            |
| 550                    | 0.978            |
| 600                    | 0.988            |
| 650                    | 0.990            |
| 700                    | 0.993            |
| 800                    | 0.996            |
| 900                    | 0.996            |
| 1 000                  | 0.996            |
| 1 200                  | 0.997            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.992            |
| 2 000                  | 0.988            |
| 2 200                  | 0.977            |
| 2 400                  | 0.961            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 604   |
| Annealing Point AP (°C)                                          | 631   |
| Transformation Temperature Tg (°C)                               | 651   |
| Yield Point At (°C)                                              | 683   |
| Softening Point SP (°C)                                          | 716   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 70    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 85    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.969 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 57                                             |
| -90 ~ -80                               | 58                                             |
| -80 ~ -70                               | 59                                             |
| -70 ~ -60                               | 60                                             |
| -60 ~ -50                               | 62                                             |
| -50 ~ -40                               | 63                                             |
| -40 ~ -30                               | 64                                             |
| -30 ~ -20                               | 65                                             |
| -20 ~ -10                               | 67                                             |
| -10 ~ 0                                 | 68                                             |
| 0 ~ 10                                  | 69                                             |
| 10 ~ 20                                 | 70                                             |
| 20 ~ 30                                 | 71                                             |
| 30 ~ 40                                 | 72                                             |
| 40 ~ 50                                 | 73                                             |
| 50 ~ 60                                 | 74                                             |
| 60 ~ 70                                 | 75                                             |
| 70 ~ 80                                 | 76                                             |
| 80 ~ 90                                 | 77                                             |
| 90 ~ 100                                | 78                                             |
| 100 ~ 110                               | 79                                             |
| 110 ~ 120                               | 80                                             |
| 120 ~ 130                               | 80                                             |
| 130 ~ 140                               | 81                                             |
| 140 ~ 150                               | 82                                             |
| 150 ~ 160                               | 83                                             |
| 160 ~ 170                               | 83                                             |
| 170 ~ 180                               | 84                                             |
| 180 ~ 190                               | 85                                             |
| 190 ~ 200                               | 85                                             |
| 200 ~ 210                               | 86                                             |
| 210 ~ 220                               | 87                                             |
| 220 ~ 230                               | 87                                             |
| 230 ~ 240                               | 88                                             |
| 240 ~ 250                               | 88                                             |
| 250 ~ 260                               | 89                                             |
| 260 ~ 270                               | 89                                             |
| 270 ~ 280                               | 90                                             |
| 280 ~ 290                               | 90                                             |
| 290 ~ 300                               | 91                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 3.31 |
| Specific Gravity $d$                                     | 3.58 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |     |     |     |      |      |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|-----|-----|-----|------|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |     |     |     |      |      |   |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e   | F   | F'  | g    | h    | i |
| -80 ~ -60                                    | -2.6                                                            | -2.3 | -1.4 | -1.1 | -1.1 | -0.5 | 0.2 | 1.6 | 2.0 | 4.4  | 8.1  | - |
| -60 ~ -40                                    | -2.5                                                            | -2.1 | -1.2 | -0.9 | -0.8 | -0.2 | 0.4 | 2.1 | 2.3 | 5.1  | 8.9  | - |
| -40 ~ -20                                    | -2.3                                                            | -1.9 | -1.0 | -0.6 | -0.5 | 0.1  | 0.8 | 2.6 | 2.8 | 5.6  | 9.8  | - |
| -20 ~ 0                                      | -2.1                                                            | -1.7 | -0.7 | -0.3 | -0.2 | 0.4  | 1.3 | 3.1 | 3.4 | 6.4  | 10.8 | - |
| 0 ~ 20                                       | -1.9                                                            | -1.4 | -0.3 | 0.0  | 0.2  | 0.9  | 1.6 | 3.7 | 4.0 | 7.1  | 11.7 | - |
| 20 ~ 40                                      | -1.6                                                            | -1.2 | -0.1 | 0.4  | 0.6  | 1.3  | 2.1 | 4.2 | 4.5 | 7.9  | 12.7 | - |
| 40 ~ 60                                      | -1.4                                                            | -0.9 | 0.3  | 0.8  | 0.9  | 1.7  | 2.5 | 4.7 | 5.0 | 8.7  | 13.7 | - |
| 60 ~ 80                                      | -1.2                                                            | -0.6 | 0.6  | 1.0  | 1.2  | 2.0  | 2.9 | 5.2 | 5.6 | 9.3  | 14.6 | - |
| 80 ~ 100                                     | -1.1                                                            | -0.5 | 0.9  | 1.4  | 1.5  | 2.4  | 3.3 | 5.7 | 6.1 | 9.9  | 15.5 | - |
| 100 ~ 120                                    | -0.9                                                            | -0.3 | 1.0  | 1.5  | 1.7  | 2.6  | 3.7 | 6.1 | 6.5 | 10.5 | 16.3 | - |
| 120 ~ 140                                    | -0.8                                                            | -0.2 | 1.2  | 1.7  | 1.9  | 2.8  | 3.9 | 6.5 | 6.9 | 11.1 | 17.1 | - |
| 140 ~ 160                                    | -0.8                                                            | -0.2 | 1.3  | 1.8  | 2.1  | 3.1  | 4.2 | 6.9 | 7.3 | 11.6 | 17.9 | - |
| 160 ~ 180                                    | -0.7                                                            | -0.1 | 1.4  | 2.0  | 2.2  | 3.2  | 4.3 | 7.1 | 7.5 | 12.1 | 18.5 | - |

## S-NPH 3

Code(d) 959175

Code(e) 972173

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.959 06<br>1.959 060 | Abbe Number $\nu_d$ | 17.47 | Dispersion $n_F - n_C$       | 0.054 895 |
| Refractive Index $n_e$ | 1.971 885             | Abbe Number $\nu_e$ | 17.33 | Dispersion $n_{F'} - n_{C'}$ | 0.056 091 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.870 64 |
| $n_{1970}$         | 1.970 09  | 1.880 02 |
| $n_{1530}$         | 1.529 58  | 1.891 31 |
| $n_{1129}$         | 1.128 64  | 1.904 12 |
| $n_t$              | 1.013 98  | 1.909 37 |
| $n_s$              | 0.852 11  | 1.919 84 |
| $n_{A'}$           | 0.768 19  | 1.927 80 |
| $n_F$              | 0.706 52  | 1.935 59 |
| $n_C$              | 0.656 27  | 1.943 76 |
| $n_{C'}$           | 0.643 85  | 1.946 12 |
| $n_{He-Ne}$        | 0.632 8   | 1.948 34 |
| $n_D$              | 0.589 29  | 1.958 60 |
| $n_d$              | 0.587 56  | 1.959 06 |
| $n_e$              | 0.546 07  | 1.971 88 |
| $n_F$              | 0.486 13  | 1.998 66 |
| $n_{F'}$           | 0.479 99  | 2.002 21 |
| $n_{He-Cd}$        | 0.441 57  | 2.029 76 |
| $n_g$              | 0.435 835 | 2.034 88 |
| $n_h$              | 0.404 656 | 2.069 65 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.098 349 03E+00 |
| $A_2$                           | 4.890 883 88E-01 |
| $A_3$                           | 2.940 092 68E+00 |
| $B_1$                           | 1.791 238 69E-02 |
| $B_2$                           | 7.766 533 53E-02 |
| $B_3$                           | 1.609 304 28E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 102.2 |
| Rigidity Modulus G (GPa) | 41.1  |
| Poisson's Ratio $\sigma$ | 0.243 |
| Knoop Hardness Hk[Class] | 500 5 |
| Abrasion Aa              | 215   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.034 388 |
| $n_C - n_{A'}$      | 0.015 956 |
| $n_d - n_C$         | 0.015 300 |
| $n_e - n_C$         | 0.028 125 |
| $n_g - n_d$         | 0.075 817 |
| $n_g - n_F$         | 0.036 222 |
| $n_h - n_g$         | 0.034 773 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.036 744 |
| $n_e - n_{C'}$      | 0.025 769 |
| $n_{F'} - n_e$      | 0.030 322 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.626 4 |
| $\theta_{C,A'}$              | 0.290 7 |
| $\theta_{d,C}$               | 0.278 7 |
| $\theta_{e,C}$               | 0.512 3 |
| $\theta_{g,d}$               | 1.381 1 |
| $\theta_{g,F}$               | 0.659 8 |
| $\theta_{h,g}$               | 0.633 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.655 1 |
| $\theta'_{e,C'}$             | 0.459 4 |
| $\theta'_{F,e}$              | 0.540 6 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.002 2 |
| $\Delta\theta_{C,A'}$ | -0.006 3 |
| $\Delta\theta_{g,d}$  | 0.052 7  |
| $\Delta\theta_{g,F}$  | 0.046 6  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |       |                  |       |
|-----------------------|-------|------------------|-------|
| $\lambda_{80}$        |       | $\lambda_5$      | 395   |
| $\lambda_{70}$        | 440   |                  |       |
|                       |       |                  |       |
| Internal transmission |       |                  |       |
| $\lambda_{0.80}$      | 430   | $\lambda_{0.05}$ | 398   |
|                       |       |                  |       |
| CCI                   |       |                  |       |
| B                     | G     |                  | R     |
| 0.00                  | 13.14 |                  | 13.56 |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    |                  |
| 380                    |                  |
| 390                    |                  |
| 400                    | 0.12             |
| 420                    | 0.72             |
| 440                    | 0.88             |
| 460                    | 0.932            |
| 480                    | 0.956            |
| 500                    | 0.970            |
| 550                    | 0.990            |
| 600                    | 0.996            |
| 650                    | 0.997            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.995            |
| 1 800                  | 0.989            |
| 2 000                  | 0.983            |
| 2 200                  | 0.968            |
| 2 400                  | 0.949            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | -    |
| Annealing Point AP (°C)                                          | -    |
| Transformation Temperature Tg (°C)                               | 672  |
| Yield Point At (°C)                                              | 707  |
| Softening Point SP (°C)                                          | -    |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 59   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 72   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.01 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 46                                             |
| -90 ~ -80                               | 47                                             |
| -80 ~ -70                               | 48                                             |
| -70 ~ -60                               | 50                                             |
| -60 ~ -50                               | 51                                             |
| -50 ~ -40                               | 52                                             |
| -40 ~ -30                               | 53                                             |
| -30 ~ -20                               | 54                                             |
| -20 ~ -10                               | 55                                             |
| -10 ~ 0                                 | 56                                             |
| 0 ~ 10                                  | 57                                             |
| 10 ~ 20                                 | 58                                             |
| 20 ~ 30                                 | 59                                             |
| 30 ~ 40                                 | 60                                             |
| 40 ~ 50                                 | 61                                             |
| 50 ~ 60                                 | 62                                             |
| 60 ~ 70                                 | 63                                             |
| 70 ~ 80                                 | 63                                             |
| 80 ~ 90                                 | 64                                             |
| 90 ~ 100                                | 65                                             |
| 100 ~ 110                               | 66                                             |
| 110 ~ 120                               | 67                                             |
| 120 ~ 130                               | 68                                             |
| 130 ~ 140                               | 68                                             |
| 140 ~ 150                               | 69                                             |
| 150 ~ 160                               | 70                                             |
| 160 ~ 170                               | 71                                             |
| 170 ~ 180                               | 71                                             |
| 180 ~ 190                               | 72                                             |
| 190 ~ 200                               | 73                                             |
| 200 ~ 210                               | 73                                             |
| 210 ~ 220                               | 74                                             |
| 220 ~ 230                               | 74                                             |
| 230 ~ 240                               | 75                                             |
| 240 ~ 250                               | 76                                             |
| 250 ~ 260                               | 76                                             |
| 260 ~ 270                               | 77                                             |
| 270 ~ 280                               | 77                                             |
| 280 ~ 290                               | 78                                             |
| 290 ~ 300                               | 78                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 3.35 |
| Specific Gravity $d$                                      | 3.59 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |     |     |     |     |      |      |      |      |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|-----|-----|-----|-----|------|------|------|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |     |     |     |     |      |      |      |      |   |
|                                              | 1550                                                            | t    | r    | C   | C'  | d   | e   | F    | F'   | g    | h    | i |
| -80 ~ -60                                    | -1.3                                                            | -0.9 | -0.1 | 0.3 | 0.4 | 1.0 | 1.6 | 3.4  | 3.7  | 6.7  | 11.3 | - |
| -60 ~ -40                                    | -1.1                                                            | -0.8 | 0.2  | 0.5 | 0.6 | 1.4 | 2.1 | 4.0  | 4.3  | 7.4  | 12.4 | - |
| -40 ~ -20                                    | -0.9                                                            | -0.4 | 0.5  | 0.9 | 1.0 | 1.8 | 2.6 | 4.5  | 4.8  | 8.3  | 13.7 | - |
| -20 ~ 0                                      | -0.6                                                            | -0.1 | 0.9  | 1.3 | 1.4 | 2.3 | 3.1 | 5.2  | 5.5  | 9.2  | 14.8 | - |
| 0 ~ 20                                       | -0.3                                                            | 0.2  | 1.3  | 1.8 | 1.9 | 2.8 | 3.7 | 5.9  | 6.2  | 10.2 | 16.1 | - |
| 20 ~ 40                                      | 0.0                                                             | 0.5  | 1.8  | 2.2 | 2.4 | 3.2 | 4.1 | 6.6  | 7.0  | 11.1 | 17.3 | - |
| 40 ~ 60                                      | 0.3                                                             | 0.9  | 2.2  | 2.7 | 2.8 | 3.7 | 4.7 | 7.2  | 7.7  | 12.0 | 18.6 | - |
| 60 ~ 80                                      | 0.6                                                             | 1.1  | 2.5  | 3.0 | 3.2 | 4.1 | 5.2 | 7.9  | 8.3  | 12.8 | 19.7 | - |
| 80 ~ 100                                     | 0.7                                                             | 1.3  | 2.8  | 3.4 | 3.6 | 4.5 | 5.6 | 8.4  | 8.8  | 13.7 | 21.0 | - |
| 100 ~ 120                                    | 0.9                                                             | 1.5  | 3.0  | 3.7 | 3.9 | 4.9 | 6.1 | 9.0  | 9.4  | 14.4 | 22.0 | - |
| 120 ~ 140                                    | 1.0                                                             | 1.7  | 3.4  | 4.0 | 4.1 | 5.2 | 6.4 | 9.5  | 9.9  | 15.1 | 23.1 | - |
| 140 ~ 160                                    | 1.1                                                             | 1.8  | 3.5  | 4.2 | 4.3 | 5.4 | 6.7 | 9.9  | 10.4 | 15.8 | 24.0 | - |
| 160 ~ 180                                    | 1.2                                                             | 1.9  | 3.6  | 4.3 | 4.5 | 5.6 | 6.9 | 10.2 | 10.7 | 16.4 | 25.1 | - |

OHARA 25-04

S-NPH 4

Code(d) 893204  
Code(e) 903202

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.892 86<br>1.892 860 | Abbe Number $\nu_d$ | 20.36 | Dispersion $n_F - n_C$       | 0.043 851 |
| Refractive Index $n_e$ | 1.903 144             | Abbe Number $\nu_e$ | 20.20 | Dispersion $n_{F'} - n_{C'}$ | 0.044 721 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.818 64 |
| $n_{1970}$         | 1.970 09  | 1.826 94 |
| $n_{1530}$         | 1.529 58  | 1.836 81 |
| $n_{1129}$         | 1.128 64  | 1.847 77 |
| $n_t$              | 1.013 98  | 1.852 18 |
| $n_s$              | 0.852 11  | 1.860 88 |
| $n_{A'}$           | 0.768 19  | 1.867 45 |
| $n_F$              | 0.706 52  | 1.873 83 |
| $n_C$              | 0.656 27  | 1.880 48 |
| $n_{C'}$           | 0.643 85  | 1.882 40 |
| $n_{He-Ne}$        | 0.632 8   | 1.884 20 |
| $n_D$              | 0.589 29  | 1.892 49 |
| $n_d$              | 0.587 56  | 1.892 86 |
| $n_e$              | 0.546 07  | 1.903 14 |
| $n_F$              | 0.486 13  | 1.924 33 |
| $n_{F'}$           | 0.479 99  | 1.927 12 |
| $n_{He-Cd}$        | 0.441 57  | 1.948 46 |
| $n_g$              | 0.435 835 | 1.952 37 |
| $n_h$              | 0.404 656 | 1.978 53 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.935 639 31E+00 |
| $A_2$                           | 4.495 964 78E-01 |
| $A_3$                           | 2.718 285 73E+00 |
| $B_1$                           | 1.525 852 89E-02 |
| $B_2$                           | 6.968 157 78E-02 |
| $B_3$                           | 1.703 271 49E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 94.5  |
| Rigidity Modulus G (GPa) | 37.7  |
| Poisson's Ratio $\sigma$ | 0.254 |
| Knoop Hardness Hk[Class] | 450 5 |
| Abrasion Aa              | 268   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.028 304 |
| $n_C - n_{A'}$      | 0.013 036 |
| $n_d - n_C$         | 0.012 376 |
| $n_e - n_C$         | 0.022 660 |
| $n_g - n_d$         | 0.059 511 |
| $n_g - n_F$         | 0.028 036 |
| $n_h - n_g$         | 0.026 158 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.030 217 |
| $n_e - n_{C'}$      | 0.020 747 |
| $n_{F'} - n_e$      | 0.023 974 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.645 5 |
| $\theta_{C,A'}$              | 0.297 3 |
| $\theta_{d,C}$               | 0.282 2 |
| $\theta_{e,C}$               | 0.516 7 |
| $\theta_{g,d}$               | 1.357 1 |
| $\theta_{g,F}$               | 0.639 3 |
| $\theta_{h,g}$               | 0.596 5 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.675 7 |
| $\theta'_{e,C'}$             | 0.463 9 |
| $\theta'_{F,e}$              | 0.536 1 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.003 3  |
| $\Delta\theta_{C,A'}$ | -0.003 2 |
| $\Delta\theta_{g,d}$  | 0.034 7  |
| $\Delta\theta_{g,F}$  | 0.030 8  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 380 |
| $\lambda_{70}$        | 410  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 409  | $\lambda_{0.05}$ | 380 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 4.93 | 5.17             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    |                  |
| 380                    | 0.06             |
| 390                    | 0.39             |
| 400                    | 0.71             |
| 420                    | 0.915            |
| 440                    | 0.951            |
| 460                    | 0.966            |
| 480                    | 0.975            |
| 500                    | 0.982            |
| 550                    | 0.993            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.995            |
| 1 800                  | 0.984            |
| 2 000                  | 0.971            |
| 2 200                  | 0.948            |
| 2 400                  | 0.915            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 650   |
| Yield Point At (°C)                                              | 685   |
| Softening Point SP (°C)                                          | 711   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 74    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 89    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.925 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 59                                             |
| -90 ~ -80                               | 61                                             |
| -80 ~ -70                               | 62                                             |
| -70 ~ -60                               | 63                                             |
| -60 ~ -50                               | 65                                             |
| -50 ~ -40                               | 66                                             |
| -40 ~ -30                               | 67                                             |
| -30 ~ -20                               | 68                                             |
| -20 ~ -10                               | 70                                             |
| -10 ~ 0                                 | 71                                             |
| 0 ~ 10                                  | 72                                             |
| 10 ~ 20                                 | 73                                             |
| 20 ~ 30                                 | 74                                             |
| 30 ~ 40                                 | 75                                             |
| 40 ~ 50                                 | 76                                             |
| 50 ~ 60                                 | 77                                             |
| 60 ~ 70                                 | 78                                             |
| 70 ~ 80                                 | 79                                             |
| 80 ~ 90                                 | 80                                             |
| 90 ~ 100                                | 81                                             |
| 100 ~ 110                               | 82                                             |
| 110 ~ 120                               | 83                                             |
| 120 ~ 130                               | 84                                             |
| 130 ~ 140                               | 84                                             |
| 140 ~ 150                               | 85                                             |
| 150 ~ 160                               | 86                                             |
| 160 ~ 170                               | 87                                             |
| 170 ~ 180                               | 87                                             |
| 180 ~ 190                               | 88                                             |
| 190 ~ 200                               | 89                                             |
| 200 ~ 210                               | 89                                             |
| 210 ~ 220                               | 90                                             |
| 220 ~ 230                               | 90                                             |
| 230 ~ 240                               | 91                                             |
| 240 ~ 250                               | 91                                             |
| 250 ~ 260                               | 92                                             |
| 260 ~ 270                               | 92                                             |
| 270 ~ 280                               | 93                                             |
| 280 ~ 290                               | 93                                             |
| 290 ~ 300                               | 94                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 3.39 |
| Specific Gravity $d$                                     | 3.61 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |     |     |     |      |   |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | -2.5                                                            | -2.2 | -1.6 | -1.4 | -1.2 | -0.8 | -0.3 | 1.0 | 1.2 | 3.2 | 6.1  | - |
| -60 ~ -40                                    | -2.5                                                            | -2.2 | -1.5 | -1.3 | -1.2 | -0.7 | -0.1 | 1.2 | 1.4 | 3.6 | 6.7  | - |
| -40 ~ -20                                    | -2.4                                                            | -2.1 | -1.4 | -1.0 | -0.9 | -0.4 | 0.1  | 1.5 | 1.7 | 4.1 | 7.4  | - |
| -20 ~ 0                                      | -2.3                                                            | -2.0 | -1.1 | -0.8 | -0.7 | -0.2 | 0.4  | 1.9 | 2.3 | 4.7 | 8.1  | - |
| 0 ~ 20                                       | -2.1                                                            | -1.8 | -0.8 | -0.5 | -0.4 | 0.2  | 0.8  | 2.4 | 2.6 | 5.3 | 9.0  | - |
| 20 ~ 40                                      | -1.9                                                            | -1.5 | -0.6 | -0.3 | -0.2 | 0.4  | 1.2  | 2.9 | 3.1 | 5.8 | 9.8  | - |
| 40 ~ 60                                      | -1.7                                                            | -1.3 | -0.4 | 0.0  | 0.2  | 0.8  | 1.6  | 3.3 | 3.6 | 6.5 | 10.6 | - |
| 60 ~ 80                                      | -1.6                                                            | -1.1 | -0.1 | 0.3  | 0.4  | 1.1  | 1.9  | 3.7 | 4.0 | 7.0 | 11.4 | - |
| 80 ~ 100                                     | -1.4                                                            | -1.0 | 0.1  | 0.5  | 0.6  | 1.4  | 2.2  | 4.2 | 4.5 | 7.6 | 12.1 | - |
| 100 ~ 120                                    | -1.3                                                            | -0.8 | 0.3  | 0.7  | 0.9  | 1.6  | 2.4  | 4.5 | 4.9 | 8.2 | 12.9 | - |
| 120 ~ 140                                    | -1.2                                                            | -0.7 | 0.5  | 0.9  | 1.1  | 1.8  | 2.7  | 4.9 | 5.3 | 8.7 | 13.6 | - |
| 140 ~ 160                                    | -1.1                                                            | -0.6 | 0.6  | 1.1  | 1.2  | 2.0  | 3.0  | 5.3 | 5.6 | 9.2 | 14.2 | - |
| 160 ~ 180                                    | -1.0                                                            | -0.6 | 0.8  | 1.3  | 1.4  | 2.3  | 3.2  | 5.5 | 5.9 | 9.6 | 14.8 | - |

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S-NPH 5

Code(d) 859227  
Code(e) 868225

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.858 96<br>1.858 956 | Abbe Number $\nu_d$ | 22.73 | Dispersion $n_F - n_C$       | 0.037 792 |
| Refractive Index $n_e$ | 1.867 836             | Abbe Number $\nu_e$ | 22.54 | Dispersion $n_{F'} - n_{C'}$ | 0.038 499 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.792 47 |
| $n_{1970}$         | 1.970 09  | 1.800 27 |
| $n_{1530}$         | 1.529 58  | 1.809 44 |
| $n_{1129}$         | 1.128 64  | 1.819 38 |
| $n_t$              | 1.013 98  | 1.823 33 |
| $n_s$              | 0.852 11  | 1.831 03 |
| $n_{A'}$           | 0.768 19  | 1.836 81 |
| $n_F$              | 0.706 52  | 1.842 40 |
| $n_C$              | 0.656 27  | 1.848 21 |
| $n_{C'}$           | 0.643 85  | 1.849 87 |
| $n_{He-Ne}$        | 0.632 8   | 1.851 45 |
| $n_D$              | 0.589 29  | 1.858 63 |
| $n_d$              | 0.587 56  | 1.858 96 |
| $n_e$              | 0.546 07  | 1.867 84 |
| $n_F$              | 0.486 13  | 1.886 00 |
| $n_{F'}$           | 0.479 99  | 1.888 37 |
| $n_{He-Cd}$        | 0.441 57  | 1.906 45 |
| $n_g$              | 0.435 835 | 1.909 75 |
| $n_h$              | 0.404 656 | 1.931 60 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.891 089 96E+00 |
| $A_2$                           | 3.952 201 26E-01 |
| $A_3$                           | 2.204 921 27E+00 |
| $B_1$                           | 1.411 644 99E-02 |
| $B_2$                           | 6.628 344 45E-02 |
| $B_3$                           | 1.486 807 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 92.9  |
| Rigidity Modulus G (GPa) | 37.0  |
| Poisson's Ratio $\sigma$ | 0.256 |
| Knoop Hardness Hk[Class] | 460   |
| Abrasion Aa              | 277   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.024 883 |
| $n_C - n_{A'}$      | 0.011 397 |
| $n_d - n_C$         | 0.010 747 |
| $n_e - n_C$         | 0.019 627 |
| $n_g - n_d$         | 0.050 792 |
| $n_g - n_F$         | 0.023 747 |
| $n_h - n_g$         | 0.021 851 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.026 548 |
| $n_e - n_{C'}$      | 0.017 962 |
| $n_{F'} - n_e$      | 0.020 537 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.658 4 |
| $\theta_{C,A'}$              | 0.301 6 |
| $\theta_{d,C}$               | 0.284 4 |
| $\theta_{e,C}$               | 0.519 3 |
| $\theta_{g,d}$               | 1.344 0 |
| $\theta_{g,F}$               | 0.628 4 |
| $\theta_{h,g}$               | 0.578 2 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.689 6 |
| $\theta'_{e,C'}$             | 0.466 6 |
| $\theta'_{F',e}$             | 0.533 4 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.005 1  |
| $\Delta\theta_{C,A'}$ | -0.001 8 |
| $\Delta\theta_{g,d}$  | 0.026 5  |
| $\Delta\theta_{g,F}$  | 0.023 7  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 370 |
| $\lambda_{70}$        | 400  |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 397  | $\lambda_{0.05}$ | 364 |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 3.38 | 3.62             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.03             |
| 370                    | 0.08             |
| 380                    | 0.41             |
| 390                    | 0.72             |
| 400                    | 0.84             |
| 420                    | 0.924            |
| 440                    | 0.949            |
| 460                    | 0.962            |
| 480                    | 0.971            |
| 500                    | 0.979            |
| 550                    | 0.991            |
| 600                    | 0.994            |
| 650                    | 0.995            |
| 700                    | 0.996            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.999            |
| 1 400                  | 0.996            |
| 1 600                  | 0.993            |
| 1 800                  | 0.984            |
| 2 000                  | 0.972            |
| 2 200                  | 0.944            |
| 2 400                  | 0.915            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 573   |
| Annealing Point AP (°C)                                          | 599   |
| Transformation Temperature Tg (°C)                               | 619   |
| Yield Point At (°C)                                              | 662   |
| Softening Point SP (°C)                                          | 704   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 69    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 86    |
| Thermal Conductivity $\lambda$ (W/(mK))                          | 0.877 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 57                                             |
| -90 ~ -80                               | 59                                             |
| -80 ~ -70                               | 60                                             |
| -70 ~ -60                               | 61                                             |
| -60 ~ -50                               | 62                                             |
| -50 ~ -40                               | 63                                             |
| -40 ~ -30                               | 64                                             |
| -30 ~ -20                               | 66                                             |
| -20 ~ -10                               | 67                                             |
| -10 ~ 0                                 | 68                                             |
| 0 ~ 10                                  | 69                                             |
| 10 ~ 20                                 | 70                                             |
| 20 ~ 30                                 | 71                                             |
| 30 ~ 40                                 | 72                                             |
| 40 ~ 50                                 | 73                                             |
| 50 ~ 60                                 | 74                                             |
| 60 ~ 70                                 | 75                                             |
| 70 ~ 80                                 | 76                                             |
| 80 ~ 90                                 | 77                                             |
| 90 ~ 100                                | 78                                             |
| 100 ~ 110                               | 79                                             |
| 110 ~ 120                               | 80                                             |
| 120 ~ 130                               | 81                                             |
| 130 ~ 140                               | 82                                             |
| 140 ~ 150                               | 82                                             |
| 150 ~ 160                               | 83                                             |
| 160 ~ 170                               | 84                                             |
| 170 ~ 180                               | 85                                             |
| 180 ~ 190                               | 86                                             |
| 190 ~ 200                               | 86                                             |
| 200 ~ 210                               | 87                                             |
| 210 ~ 220                               | 88                                             |
| 220 ~ 230                               | 89                                             |
| 230 ~ 240                               | 89                                             |
| 240 ~ 250                               | 90                                             |
| 250 ~ 260                               | 91                                             |
| 260 ~ 270                               | 91                                             |
| 270 ~ 280                               | 92                                             |
| 280 ~ 290                               | 93                                             |
| 290 ~ 300                               | 93                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 3.18 |
| Specific Gravity $d$                                     | 3.71 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t    | r    | C    | C'   | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | -1.5                                                            | -1.3 | -0.6 | -0.4 | -0.4 | 0.0 | 0.4 | 1.5 | 1.7 | 3.4 | 5.6  | - |
| -60 ~ -40                                    | -1.4                                                            | -1.2 | -0.5 | -0.3 | -0.2 | 0.2 | 0.6 | 1.8 | 1.9 | 3.7 | 6.1  | - |
| -40 ~ -20                                    | -1.4                                                            | -1.0 | -0.4 | -0.2 | -0.1 | 0.3 | 0.8 | 2.1 | 2.2 | 4.1 | 6.7  | - |
| -20 ~ 0                                      | -1.2                                                            | -0.9 | -0.2 | 0.0  | 0.1  | 0.7 | 1.2 | 2.4 | 2.6 | 4.5 | 7.3  | - |
| 0 ~ 20                                       | -1.0                                                            | -0.7 | 0.0  | 0.4  | 0.4  | 1.0 | 1.5 | 2.8 | 3.0 | 5.1 | 8.0  | - |
| 20 ~ 40                                      | -0.8                                                            | -0.5 | 0.3  | 0.6  | 0.7  | 1.2 | 1.8 | 3.2 | 3.4 | 5.6 | 8.6  | - |
| 40 ~ 60                                      | -0.6                                                            | -0.3 | 0.5  | 0.8  | 0.9  | 1.5 | 2.1 | 3.6 | 3.8 | 6.1 | 9.2  | - |
| 60 ~ 80                                      | -0.5                                                            | -0.2 | 0.8  | 1.0  | 1.1  | 1.8 | 2.4 | 3.9 | 4.1 | 6.5 | 9.8  | - |
| 80 ~ 100                                     | -0.4                                                            | 0.0  | 0.9  | 1.2  | 1.3  | 1.9 | 2.6 | 4.3 | 4.5 | 7.0 | 10.4 | - |
| 100 ~ 120                                    | -0.3                                                            | 0.1  | 1.1  | 1.4  | 1.5  | 2.1 | 2.8 | 4.5 | 4.7 | 7.4 | 11.0 | - |
| 120 ~ 140                                    | -0.2                                                            | 0.2  | 1.2  | 1.5  | 1.6  | 2.3 | 3.0 | 4.7 | 5.0 | 7.8 | 11.4 | - |
| 140 ~ 160                                    | -0.2                                                            | 0.2  | 1.2  | 1.6  | 1.7  | 2.4 | 3.1 | 5.0 | 5.3 | 8.1 | 11.9 | - |
| 160 ~ 180                                    | -0.3                                                            | 0.2  | 1.2  | 1.7  | 1.8  | 2.5 | 3.3 | 5.1 | 5.4 | 8.3 | 12.3 | - |

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## S-NPH 7

Code(d) 778239

Code(e) 786237

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.778 30<br>1.778 300 | Abbe Number $\nu_d$ | 23.91 | Dispersion $n_F - n_C$       | 0.032 549 |
| Refractive Index $n_e$ | 1.785 954             | Abbe Number $\nu_e$ | 23.71 | Dispersion $n_{F'} - n_{C'}$ | 0.033 147 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.720 77 |
| $n_{1970}$         | 1.970 09  | 1.727 50 |
| $n_{1530}$         | 1.529 58  | 1.735 44 |
| $n_{1129}$         | 1.128 64  | 1.744 06 |
| $n_t$              | 1.013 98  | 1.747 49 |
| $n_s$              | 0.852 11  | 1.754 17 |
| $n_{A'}$           | 0.768 19  | 1.759 17 |
| $n_F$              | 0.706 52  | 1.764 00 |
| $n_C$              | 0.656 27  | 1.769 02 |
| $n_{C'}$           | 0.643 85  | 1.770 46 |
| $n_{He-Ne}$        | 0.632 8   | 1.771 82 |
| $n_D$              | 0.589 29  | 1.778 02 |
| $n_d$              | 0.587 56  | 1.778 30 |
| $n_e$              | 0.546 07  | 1.785 95 |
| $n_F$              | 0.486 13  | 1.801 57 |
| $n_{F'}$           | 0.479 99  | 1.803 61 |
| $n_{He-Cd}$        | 0.441 57  | 1.819 09 |
| $n_g$              | 0.435 835 | 1.821 91 |
| $n_h$              | 0.404 656 | 1.840 53 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.682 365 54E+00 |
| $A_2$                           | 3.396 496 44E-01 |
| $A_3$                           | 2.250 492 08E+00 |
| $B_1$                           | 1.314 316 82E-02 |
| $B_2$                           | 6.450 400 12E-02 |
| $B_3$                           | 1.813 863 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 75.3  |
| Rigidity Modulus G (GPa) | 29.6  |
| Poisson's Ratio $\sigma$ | 0.269 |
| Knoop Hardness Hk[Class] | 380 4 |
| Abrasion Aa              | 448   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.021 538 |
| $n_C - n_{A'}$      | 0.009 855 |
| $n_d - n_C$         | 0.009 276 |
| $n_e - n_C$         | 0.016 930 |
| $n_g - n_d$         | 0.043 611 |
| $n_g - n_F$         | 0.020 338 |
| $n_h - n_g$         | 0.018 622 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.022 976 |
| $n_e - n_{C'}$      | 0.015 492 |
| $n_{F'} - n_e$      | 0.017 655 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.661 7 |
| $\theta_{C,A'}$              | 0.302 8 |
| $\theta_{d,C}$               | 0.285 0 |
| $\theta_{e,C}$               | 0.520 1 |
| $\theta_{g,d}$               | 1.339 9 |
| $\theta_{g,F}$               | 0.624 8 |
| $\theta_{h,g}$               | 0.572 1 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.693 2 |
| $\theta'_{e,C'}$             | 0.467 4 |
| $\theta'_{F',e}$             | 0.532 6 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.002 9  |
| $\Delta\theta_{C,A'}$ | -0.002 0 |
| $\Delta\theta_{g,d}$  | 0.024 9  |
| $\Delta\theta_{g,F}$  | 0.022 0  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 420  | $\lambda_5$      | 370 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 395  | $\lambda_{0.05}$ | 365 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.61 | 2.69             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.11             |
| 380                    | 0.45             |
| 390                    | 0.74             |
| 400                    | 0.87             |
| 420                    | 0.949            |
| 440                    | 0.971            |
| 460                    | 0.980            |
| 480                    | 0.986            |
| 500                    | 0.990            |
| 550                    | 0.996            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.995            |
| 1 800                  | 0.984            |
| 2 000                  | 0.970            |
| 2 200                  | 0.951            |
| 2 400                  | 0.920            |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 520   |
| Annealing Point AP (°C)                                          | 541   |
| Transformation Temperature Tg (°C)                               | 570   |
| Yield Point At (°C)                                              | 598   |
| Softening Point SP (°C)                                          | 630   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 109   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 132   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.826 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 89                                             |
| -90 ~ -80                               | 91                                             |
| -80 ~ -70                               | 93                                             |
| -70 ~ -60                               | 95                                             |
| -60 ~ -50                               | 97                                             |
| -50 ~ -40                               | 99                                             |
| -40 ~ -30                               | 100                                            |
| -30 ~ -20                               | 102                                            |
| -20 ~ -10                               | 104                                            |
| -10 ~ 0                                 | 106                                            |
| 0 ~ 10                                  | 107                                            |
| 10 ~ 20                                 | 109                                            |
| 20 ~ 30                                 | 110                                            |
| 30 ~ 40                                 | 112                                            |
| 40 ~ 50                                 | 113                                            |
| 50 ~ 60                                 | 115                                            |
| 60 ~ 70                                 | 116                                            |
| 70 ~ 80                                 | 118                                            |
| 80 ~ 90                                 | 119                                            |
| 90 ~ 100                                | 121                                            |
| 100 ~ 110                               | 122                                            |
| 110 ~ 120                               | 123                                            |
| 120 ~ 130                               | 124                                            |
| 130 ~ 140                               | 126                                            |
| 140 ~ 150                               | 127                                            |
| 150 ~ 160                               | 128                                            |
| 160 ~ 170                               | 129                                            |
| 170 ~ 180                               | 130                                            |
| 180 ~ 190                               | 131                                            |
| 190 ~ 200                               | 132                                            |
| 200 ~ 210                               | 133                                            |
| 210 ~ 220                               | 134                                            |
| 220 ~ 230                               | 135                                            |
| 230 ~ 240                               | 136                                            |
| 240 ~ 250                               | 137                                            |
| 250 ~ 260                               | 137                                            |
| 260 ~ 270                               | 138                                            |
| 270 ~ 280                               | 139                                            |
| 280 ~ 290                               | 140                                            |
| 290 ~ 300                               | 140                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 3.45 |
| Specific Gravity $d$                                      | 3.30 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |     |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |     |   |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h   | i |
| -80 ~ -60                                    | -5.8                                                            | -5.6 | -5.1 | -5.0 | -4.9 | -4.5 | -4.1 | -3.3 | -3.1 | -1.6 | 0.4 | - |
| -60 ~ -40                                    | -6.0                                                            | -5.8 | -5.3 | -5.1 | -5.0 | -4.6 | -4.3 | -3.3 | -3.2 | -1.6 | 0.5 | - |
| -40 ~ -20                                    | -6.1                                                            | -5.9 | -5.3 | -5.1 | -5.1 | -4.7 | -4.3 | -3.2 | -3.1 | -1.5 | 0.7 | - |
| -20 ~ 0                                      | -6.2                                                            | -6.0 | -5.3 | -5.2 | -5.1 | -4.6 | -4.2 | -3.2 | -3.0 | -1.3 | 1.1 | - |
| 0 ~ 20                                       | -6.2                                                            | -6.0 | -5.3 | -5.0 | -5.0 | -4.6 | -4.1 | -3.0 | -2.8 | -1.0 | 1.5 | - |
| 20 ~ 40                                      | -6.2                                                            | -5.9 | -5.3 | -5.1 | -5.0 | -4.5 | -4.0 | -2.8 | -2.6 | -0.8 | 1.8 | - |
| 40 ~ 60                                      | -6.2                                                            | -5.9 | -5.2 | -4.9 | -4.8 | -4.4 | -3.9 | -2.6 | -2.5 | -0.5 | 2.1 | - |
| 60 ~ 80                                      | -6.1                                                            | -5.8 | -5.1 | -4.9 | -4.8 | -4.3 | -3.8 | -2.5 | -2.3 | -0.2 | 2.6 | - |
| 80 ~ 100                                     | -6.2                                                            | -5.9 | -5.0 | -4.8 | -4.7 | -4.2 | -3.6 | -2.3 | -2.1 | 0.0  | 2.9 | - |
| 100 ~ 120                                    | -6.2                                                            | -5.9 | -5.0 | -4.7 | -4.6 | -4.1 | -3.5 | -2.1 | -1.9 | 0.3  | 3.3 | - |
| 120 ~ 140                                    | -6.2                                                            | -5.8 | -5.0 | -4.7 | -4.6 | -4.1 | -3.5 | -2.0 | -1.8 | 0.5  | 3.6 | - |
| 140 ~ 160                                    | -6.2                                                            | -5.8 | -5.0 | -4.7 | -4.6 | -4.0 | -3.4 | -1.9 | -1.7 | 0.7  | 3.9 | - |
| 160 ~ 180                                    | -6.3                                                            | -5.9 | -5.1 | -4.7 | -4.6 | -4.1 | -3.4 | -1.9 | -1.6 | 0.9  | 4.2 | - |

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## S-NSL 3

Code(d) 518590

Code(e) 520586

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.518 23<br>1.518 229 | Abbe Number $\nu_d$ | 58.90 | Dispersion $n_F - n_C$       | 0.008 798 |
| Refractive Index $n_e$ | 1.520 326             | Abbe Number $\nu_e$ | 58.63 | Dispersion $n_{F'} - n_{C'}$ | 0.008 875 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.492 73 |
| $n_{1970}$         | 1.970 09  | 1.497 47 |
| $n_{1530}$         | 1.529 58  | 1.502 52 |
| $n_{1129}$         | 1.128 64  | 1.506 92 |
| $n_t$              | 1.013 98  | 1.508 35 |
| $n_s$              | 0.852 11  | 1.510 83 |
| $n_{A'}$           | 0.768 19  | 1.512 50 |
| $n_F$              | 0.706 52  | 1.514 03 |
| $n_C$              | 0.656 27  | 1.515 56 |
| $n_{C'}$           | 0.643 85  | 1.515 98 |
| $n_{He-Ne}$        | 0.632 8   | 1.516 38 |
| $n_D$              | 0.589 29  | 1.518 15 |
| $n_d$              | 0.587 56  | 1.518 23 |
| $n_e$              | 0.546 07  | 1.520 33 |
| $n_F$              | 0.486 13  | 1.524 35 |
| $n_{F'}$           | 0.479 99  | 1.524 86 |
| $n_{He-Cd}$        | 0.441 57  | 1.528 52 |
| $n_g$              | 0.435 835 | 1.529 15 |
| $n_h$              | 0.404 656 | 1.533 15 |
| $n_i$              | 0.365 015 | 1.539 99 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 8.825 147 64E-01 |
| $A_2$                           | 3.892 719 07E-01 |
| $A_3$                           | 1.106 934 48E+00 |
| $B_1$                           | 4.645 045 82E-03 |
| $B_2$                           | 2.005 513 97E-02 |
| $B_3$                           | 1.362 343 39E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 3   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 70.0  |
| Rigidity Modulus G (GPa) | 28.8  |
| Poisson's Ratio $\sigma$ | 0.217 |
| Knoop Hardness Hk[Class] | 520 5 |
| Abrasion Aa              | 117   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.007 206 |
| $n_C - n_{A'}$      | 0.003 052 |
| $n_d - n_C$         | 0.002 673 |
| $n_e - n_C$         | 0.004 770 |
| $n_g - n_d$         | 0.010 926 |
| $n_g - n_F$         | 0.004 801 |
| $n_h - n_g$         | 0.003 996 |
| $n_i - n_g$         | 0.010 832 |
| $n_{C'} - n_t$      | 0.007 631 |
| $n_e - n_{C'}$      | 0.004 345 |
| $n_{F'} - n_e$      | 0.004 530 |
| $n_i - n_{F'}$      | 0.015 131 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.819 0 |
| $\theta_{C,A'}$              | 0.346 9 |
| $\theta_{d,C}$               | 0.303 8 |
| $\theta_{e,C}$               | 0.542 2 |
| $\theta_{g,d}$               | 1.241 9 |
| $\theta_{g,F}$               | 0.545 7 |
| $\theta_{h,g}$               | 0.454 2 |
| $\theta_{i,g}$               | 1.231 2 |
| $\theta'_{C,t}$              | 0.859 8 |
| $\theta'_{e,C'}$             | 0.489 6 |
| $\theta'_{F',e}$             | 0.510 4 |
| $\theta'_{i,F'}$             | 1.704 9 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.004 0 |
| $\Delta\theta_{C,A'}$ | -0.000 4 |
| $\Delta\theta_{g,d}$  | -0.000 5 |
| $\Delta\theta_{g,F}$  | -0.000 5 |
| $\Delta\theta_{i,g}$  | -0.000 6 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 340  | $\lambda_5$      | 310 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 340  | $\lambda_{0.05}$ | 317 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.09 | 0.06             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    | 0.15             |
| 330                    | 0.53             |
| 340                    | 0.80             |
| 350                    | 0.924            |
| 360                    | 0.968            |
| 370                    | 0.984            |
| 380                    | 0.990            |
| 390                    | 0.995            |
| 400                    | 0.997            |
| 420                    | 0.997            |
| 440                    | 0.997            |
| 460                    | 0.997            |
| 480                    | 0.998            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.992            |
| 1 600                  | 0.991            |
| 1 800                  | 0.968            |
| 2 000                  | 0.930            |
| 2 200                  | 0.86             |
| 2 400                  | 0.81             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 455  |
| Annealing Point AP (°C)                                          | 492  |
| Transformation Temperature Tg (°C)                               | 508  |
| Yield Point At (°C)                                              | 559  |
| Softening Point SP (°C)                                          | 668  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 92   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 114  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.03 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 75                                             |
| -90 ~ -80                               | 76                                             |
| -80 ~ -70                               | 78                                             |
| -70 ~ -60                               | 80                                             |
| -60 ~ -50                               | 81                                             |
| -50 ~ -40                               | 83                                             |
| -40 ~ -30                               | 85                                             |
| -30 ~ -20                               | 86                                             |
| -20 ~ -10                               | 88                                             |
| -10 ~ 0                                 | 89                                             |
| 0 ~ 10                                  | 91                                             |
| 10 ~ 20                                 | 92                                             |
| 20 ~ 30                                 | 94                                             |
| 30 ~ 40                                 | 95                                             |
| 40 ~ 50                                 | 96                                             |
| 50 ~ 60                                 | 98                                             |
| 60 ~ 70                                 | 99                                             |
| 70 ~ 80                                 | 100                                            |
| 80 ~ 90                                 | 102                                            |
| 90 ~ 100                                | 103                                            |
| 100 ~ 110                               | 104                                            |
| 110 ~ 120                               | 105                                            |
| 120 ~ 130                               | 106                                            |
| 130 ~ 140                               | 107                                            |
| 140 ~ 150                               | 109                                            |
| 150 ~ 160                               | 110                                            |
| 160 ~ 170                               | 111                                            |
| 170 ~ 180                               | 112                                            |
| 180 ~ 190                               | 113                                            |
| 190 ~ 200                               | 113                                            |
| 200 ~ 210                               | 114                                            |
| 210 ~ 220                               | 115                                            |
| 220 ~ 230                               | 116                                            |
| 230 ~ 240                               | 117                                            |
| 240 ~ 250                               | 118                                            |
| 250 ~ 260                               | 118                                            |
| 260 ~ 270                               | 119                                            |
| 270 ~ 280                               | 120                                            |
| 280 ~ 290                               | 120                                            |
| 290 ~ 300                               | 121                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.60 |
| Specific Gravity $d$                                     | 2.48 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t    | r    | C    | C'   | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | -0.3                                                            | -0.2 | 0.0  | 0.1  | 0.2  | 0.4 | 0.5 | 0.7 | 0.8 | 1.1 | 1.4 | 1.9 |
| -60 ~ -40                                    | -0.5                                                            | -0.4 | -0.1 | 0.1  | 0.1  | 0.2 | 0.4 | 0.6 | 0.7 | 1.0 | 1.2 | 1.8 |
| -40 ~ -20                                    | -0.6                                                            | -0.4 | -0.2 | 0.0  | 0.0  | 0.2 | 0.3 | 0.6 | 0.6 | 0.9 | 1.2 | 1.8 |
| -20 ~ 0                                      | -0.6                                                            | -0.5 | -0.1 | 0.0  | 0.0  | 0.2 | 0.3 | 0.6 | 0.6 | 0.9 | 1.2 | 1.8 |
| 0 ~ 20                                       | -0.6                                                            | -0.4 | -0.1 | 0.0  | 0.0  | 0.1 | 0.3 | 0.5 | 0.6 | 1.0 | 1.3 | 1.8 |
| 20 ~ 40                                      | -0.5                                                            | -0.4 | -0.1 | 0.0  | 0.0  | 0.2 | 0.3 | 0.6 | 0.6 | 1.0 | 1.3 | 1.9 |
| 40 ~ 60                                      | -0.6                                                            | -0.3 | 0.0  | 0.1  | 0.1  | 0.2 | 0.4 | 0.7 | 0.7 | 1.0 | 1.3 | 1.9 |
| 60 ~ 80                                      | -0.6                                                            | -0.4 | -0.1 | 0.0  | 0.0  | 0.2 | 0.3 | 0.7 | 0.8 | 1.1 | 1.4 | 2.0 |
| 80 ~ 100                                     | -0.6                                                            | -0.4 | -0.1 | 0.0  | 0.0  | 0.2 | 0.3 | 0.6 | 0.7 | 1.0 | 1.4 | 2.0 |
| 100 ~ 120                                    | -0.6                                                            | -0.4 | -0.1 | 0.0  | 0.0  | 0.2 | 0.3 | 0.6 | 0.7 | 1.0 | 1.4 | 2.0 |
| 120 ~ 140                                    | -0.7                                                            | -0.5 | -0.1 | -0.1 | -0.1 | 0.2 | 0.3 | 0.7 | 0.7 | 1.1 | 1.4 | 2.0 |
| 140 ~ 160                                    | -0.7                                                            | -0.5 | -0.2 | -0.1 | -0.1 | 0.1 | 0.3 | 0.6 | 0.6 | 1.0 | 1.3 | 1.9 |
| 160 ~ 180                                    | -0.8                                                            | -0.7 | -0.3 | -0.2 | -0.2 | 0.0 | 0.1 | 0.4 | 0.5 | 0.8 | 1.2 | 1.8 |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.517 42<br>1.517 417 | Abbe Number $\nu_d$ | 52.43 | Dispersion $n_F - n_C$       | 0.009 869 |
| Refractive Index $n_e$ | 1.519 765             | Abbe Number $\nu_e$ | 52.14 | Dispersion $n_{F'} - n_{C'}$ | 0.009 968 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.490 04 |
| $n_{1970}$         | 1.970 09  | 1.495 01 |
| $n_{1530}$         | 1.529 58  | 1.500 33 |
| $n_{1129}$         | 1.128 64  | 1.505 01 |
| $n_t$              | 1.013 98  | 1.506 56 |
| $n_s$              | 0.852 11  | 1.509 24 |
| $n_{A'}$           | 0.768 19  | 1.511 08 |
| $n_F$              | 0.706 52  | 1.512 76 |
| $n_C$              | 0.656 27  | 1.514 44 |
| $n_{C'}$           | 0.643 85  | 1.514 92 |
| $n_{He-Ne}$        | 0.632 8   | 1.515 36 |
| $n_D$              | 0.589 29  | 1.517 33 |
| $n_d$              | 0.587 56  | 1.517 42 |
| $n_e$              | 0.546 07  | 1.519 76 |
| $n_F$              | 0.486 13  | 1.524 31 |
| $n_{F'}$           | 0.479 99  | 1.524 88 |
| $n_{He-Cd}$        | 0.441 57  | 1.529 07 |
| $n_g$              | 0.435 835 | 1.529 80 |
| $n_h$              | 0.404 656 | 1.534 44 |
| $n_i$              | 0.365 015 | 1.542 52 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.096 661 53E+00 |
| $A_2$                           | 1.689 900 73E-01 |
| $A_3$                           | 1.205 808 27E+00 |
| $B_1$                           | 6.674 911 23E-03 |
| $B_2$                           | 3.360 954 50E-02 |
| $B_3$                           | 1.416 687 38E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 64.0  |
| Rigidity Modulus G (GPa) | 28.1  |
| Poisson's Ratio $\sigma$ | 0.139 |
| Knoop Hardness Hk[Class] | 480   |
| Abrasion Aa              | 113   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.007 887 |
| $n_C - n_{A'}$      | 0.003 365 |
| $n_d - n_C$         | 0.002 973 |
| $n_e - n_C$         | 0.005 321 |
| $n_g - n_d$         | 0.012 387 |
| $n_g - n_F$         | 0.005 491 |
| $n_h - n_g$         | 0.004 635 |
| $n_i - n_g$         | 0.012 715 |
| $n_{C'} - n_t$      | 0.008 359 |
| $n_e - n_{C'}$      | 0.004 849 |
| $n_{F'} - n_e$      | 0.005 119 |
| $n_i - n_{F'}$      | 0.017 635 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.799 2 |
| $\theta_{C,A'}$              | 0.341 0 |
| $\theta_{d,C}$               | 0.301 2 |
| $\theta_{e,C}$               | 0.539 2 |
| $\theta_{g,d}$               | 1.255 1 |
| $\theta_{g,F}$               | 0.556 4 |
| $\theta_{h,g}$               | 0.469 7 |
| $\theta_{i,g}$               | 1.288 4 |
| $\theta'_{C,t}$              | 0.838 6 |
| $\theta'_{e,C'}$             | 0.486 5 |
| $\theta'_{F',e}$             | 0.513 5 |
| $\theta'_{i,F'}$             | 1.769 2 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.006 5  |
| $\Delta\theta_{C,A'}$ | 0.001 6  |
| $\Delta\theta_{g,d}$  | -0.000 7 |
| $\Delta\theta_{g,F}$  | -0.000 2 |
| $\Delta\theta_{i,g}$  | 0.002 4  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 360  | $\lambda_5$      | 335 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 360  | $\lambda_{0.05}$ | 337 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.22 | 0.20             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.18             |
| 350                    | 0.57             |
| 360                    | 0.81             |
| 370                    | 0.917            |
| 380                    | 0.960            |
| 390                    | 0.980            |
| 400                    | 0.989            |
| 420                    | 0.995            |
| 440                    | 0.996            |
| 460                    | 0.997            |
| 480                    | 0.998            |
| 500                    | 0.998            |
| 550                    | 0.999            |
| 600                    | 0.999            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.996            |
| 1 600                  | 0.994            |
| 1 800                  | 0.978            |
| 2 000                  | 0.950            |
| 2 200                  | 0.89             |
| 2 400                  | 0.86             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 429  |
| Annealing Point AP (°C)                                          | 465  |
| Transformation Temperature Tg (°C)                               | 473  |
| Yield Point At (°C)                                              | 546  |
| Softening Point SP (°C)                                          | 655  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 81   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 98   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.09 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 66                                             |
| -90 ~ -80                               | 68                                             |
| -80 ~ -70                               | 69                                             |
| -70 ~ -60                               | 71                                             |
| -60 ~ -50                               | 72                                             |
| -50 ~ -40                               | 74                                             |
| -40 ~ -30                               | 75                                             |
| -30 ~ -20                               | 77                                             |
| -20 ~ -10                               | 78                                             |
| -10 ~ 0                                 | 79                                             |
| 0 ~ 10                                  | 81                                             |
| 10 ~ 20                                 | 82                                             |
| 20 ~ 30                                 | 83                                             |
| 30 ~ 40                                 | 84                                             |
| 40 ~ 50                                 | 85                                             |
| 50 ~ 60                                 | 86                                             |
| 60 ~ 70                                 | 88                                             |
| 70 ~ 80                                 | 89                                             |
| 80 ~ 90                                 | 90                                             |
| 90 ~ 100                                | 90                                             |
| 100 ~ 110                               | 91                                             |
| 110 ~ 120                               | 92                                             |
| 120 ~ 130                               | 93                                             |
| 130 ~ 140                               | 94                                             |
| 140 ~ 150                               | 95                                             |
| 150 ~ 160                               | 95                                             |
| 160 ~ 170                               | 96                                             |
| 170 ~ 180                               | 97                                             |
| 180 ~ 190                               | 97                                             |
| 190 ~ 200                               | 98                                             |
| 200 ~ 210                               | 98                                             |
| 210 ~ 220                               | 99                                             |
| 220 ~ 230                               | 99                                             |
| 230 ~ 240                               | 100                                            |
| 240 ~ 250                               | 100                                            |
| 250 ~ 260                               | 100                                            |
| 260 ~ 270                               | 101                                            |
| 270 ~ 280                               | 101                                            |
| 280 ~ 290                               | 101                                            |
| 290 ~ 300                               | 101                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.82 |
| Specific Gravity $d$                                     | 2.46 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.3                                                             | 1.4 | 1.6 | 1.8 | 1.8 | 1.9 | 2.0 | 2.3 | 2.3 | 2.6 | 3.1 | 3.8 |
| -60 ~ -40                                    | 1.1                                                             | 1.2 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.2 | 2.2 | 2.6 | 2.9 | 3.8 |
| -40 ~ -20                                    | 1.0                                                             | 1.2 | 1.5 | 1.6 | 1.6 | 1.7 | 1.9 | 2.1 | 2.2 | 2.5 | 2.9 | 3.8 |
| -20 ~ 0                                      | 1.0                                                             | 1.2 | 1.5 | 1.6 | 1.6 | 1.7 | 1.9 | 2.2 | 2.2 | 2.6 | 3.0 | 3.9 |
| 0 ~ 20                                       | 1.1                                                             | 1.2 | 1.5 | 1.6 | 1.6 | 1.7 | 1.9 | 2.2 | 2.2 | 2.7 | 3.1 | 4.0 |
| 20 ~ 40                                      | 1.1                                                             | 1.3 | 1.5 | 1.6 | 1.7 | 1.8 | 2.0 | 2.4 | 2.4 | 2.8 | 3.3 | 4.1 |
| 40 ~ 60                                      | 1.1                                                             | 1.4 | 1.7 | 1.8 | 1.8 | 1.9 | 2.1 | 2.4 | 2.5 | 2.9 | 3.3 | 4.3 |
| 60 ~ 80                                      | 1.2                                                             | 1.4 | 1.7 | 1.8 | 1.8 | 2.0 | 2.1 | 2.6 | 2.6 | 3.1 | 3.5 | 4.5 |
| 80 ~ 100                                     | 1.3                                                             | 1.4 | 1.8 | 1.9 | 1.9 | 2.1 | 2.2 | 2.6 | 2.6 | 3.2 | 3.7 | 4.6 |
| 100 ~ 120                                    | 1.3                                                             | 1.5 | 1.8 | 1.9 | 1.9 | 2.1 | 2.3 | 2.7 | 2.7 | 3.2 | 3.7 | 4.8 |
| 120 ~ 140                                    | 1.3                                                             | 1.5 | 1.9 | 1.9 | 2.0 | 2.2 | 2.4 | 2.8 | 2.9 | 3.3 | 3.9 | 4.9 |
| 140 ~ 160                                    | 1.4                                                             | 1.6 | 1.9 | 2.0 | 2.1 | 2.3 | 2.4 | 2.8 | 2.9 | 3.4 | 3.9 | 5.0 |
| 160 ~ 180                                    | 1.4                                                             | 1.6 | 1.9 | 2.0 | 2.1 | 2.2 | 2.4 | 2.8 | 2.9 | 3.4 | 3.9 | 5.1 |

## S-PHM52

Code(d) 618634  
Code(e) 620630

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.618 00<br>1.618 000 | Abbe Number $\nu_d$ | 63.33 | Dispersion $n_F - n_C$       | 0.009 758 |
| Refractive Index $n_e$ | 1.620 327             | Abbe Number $\nu_e$ | 63.02 | Dispersion $n_{F'} - n_{C'}$ | 0.009 844 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.591 08 |
| $n_{1970}$         | 1.970 09  | 1.595 87 |
| $n_{1530}$         | 1.529 58  | 1.601 03 |
| $n_{1129}$         | 1.128 64  | 1.605 61 |
| $n_t$              | 1.013 98  | 1.607 14 |
| $n_s$              | 0.852 11  | 1.609 83 |
| $n_{A'}$           | 0.768 19  | 1.611 67 |
| $n_F$              | 0.706 52  | 1.613 35 |
| $n_C$              | 0.656 27  | 1.615 04 |
| $n_{C'}$           | 0.643 85  | 1.615 51 |
| $n_{He-Ne}$        | 0.632 8   | 1.615 95 |
| $n_D$              | 0.589 29  | 1.617 91 |
| $n_d$              | 0.587 56  | 1.618 00 |
| $n_e$              | 0.546 07  | 1.620 33 |
| $n_F$              | 0.486 13  | 1.624 79 |
| $n_{F'}$           | 0.479 99  | 1.625 35 |
| $n_{He-Cd}$        | 0.441 57  | 1.629 40 |
| $n_g$              | 0.435 835 | 1.630 10 |
| $n_h$              | 0.404 656 | 1.634 51 |
| $n_i$              | 0.365 015 | 1.641 99 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 1.099 665 50E+00  |
| $A_2$                           | 4.781 254 22E-01  |
| $A_3$                           | 1.132 140 74E+00  |
| $B_1$                           | 1.327 185 59E-02  |
| $B_2$                           | -6.016 496 85E-04 |
| $B_3$                           | 1.305 954 72E+02  |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 4   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 5.0 |
| Phosphate Resistance PR                   | 4.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 71.5  |
| Rigidity Modulus G (GPa) | 27.7  |
| Poisson's Ratio $\sigma$ | 0.292 |
| Knoop Hardness Hk[Class] | 380 4 |
| Abrasion Aa              | 468   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.007 893 |
| $n_C - n_{A'}$      | 0.003 370 |
| $n_d - n_C$         | 0.002 964 |
| $n_e - n_C$         | 0.005 291 |
| $n_g - n_d$         | 0.012 103 |
| $n_g - n_F$         | 0.005 309 |
| $n_h - n_g$         | 0.004 403 |
| $n_i - n_g$         | 0.011 891 |
| $n_{C'} - n_t$      | 0.008 364 |
| $n_e - n_{C'}$      | 0.004 820 |
| $n_{F'} - n_e$      | 0.005 024 |
| $n_i - n_{F'}$      | 0.016 643 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.808 9 |
| $\theta_{C,A'}$              | 0.345 4 |
| $\theta_{d,C}$               | 0.303 8 |
| $\theta_{e,C}$               | 0.542 2 |
| $\theta_{g,d}$               | 1.240 3 |
| $\theta_{g,F}$               | 0.544 1 |
| $\theta_{h,g}$               | 0.451 2 |
| $\theta_{i,g}$               | 1.218 6 |
| $\theta'_{C,t}$              | 0.849 7 |
| $\theta'_{e,C'}$             | 0.489 6 |
| $\theta'_{F,e}$              | 0.510 4 |
| $\theta'_{i,F'}$             | 1.690 7 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.034 9 |
| $\Delta\theta_{C,A'}$ | -0.007 2 |
| $\Delta\theta_{g,d}$  | 0.007 1  |
| $\Delta\theta_{g,F}$  | 0.005 1  |
| $\Delta\theta_{i,g}$  | 0.023 9  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 370  | $\lambda_5$      | 325 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 366  | $\lambda_{0.05}$ | 330 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.55 | 0.57             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    | 0.05             |
| 340                    | 0.25             |
| 350                    | 0.51             |
| 360                    | 0.72             |
| 370                    | 0.85             |
| 380                    | 0.923            |
| 390                    | 0.957            |
| 400                    | 0.974            |
| 420                    | 0.986            |
| 440                    | 0.990            |
| 460                    | 0.992            |
| 480                    | 0.994            |
| 500                    | 0.996            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.997            |
| 900                    | 0.996            |
| 1 000                  | 0.996            |
| 1 200                  | 0.996            |
| 1 400                  | 0.996            |
| 1 600                  | 0.991            |
| 1 800                  | 0.979            |
| 2 000                  | 0.961            |
| 2 200                  | 0.926            |
| 2 400                  | 0.89             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 585   |
| Yield Point At (°C)                                              | 626   |
| Softening Point SP (°C)                                          | -     |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 102   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 120   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.599 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 86                                             |
| -90 ~ -80                               | 87                                             |
| -80 ~ -70                               | 89                                             |
| -70 ~ -60                               | 90                                             |
| -60 ~ -50                               | 92                                             |
| -50 ~ -40                               | 93                                             |
| -40 ~ -30                               | 95                                             |
| -30 ~ -20                               | 96                                             |
| -20 ~ -10                               | 97                                             |
| -10 ~ 0                                 | 99                                             |
| 0 ~ 10                                  | 100                                            |
| 10 ~ 20                                 | 101                                            |
| 20 ~ 30                                 | 103                                            |
| 30 ~ 40                                 | 104                                            |
| 40 ~ 50                                 | 105                                            |
| 50 ~ 60                                 | 106                                            |
| 60 ~ 70                                 | 108                                            |
| 70 ~ 80                                 | 109                                            |
| 80 ~ 90                                 | 110                                            |
| 90 ~ 100                                | 111                                            |
| 100 ~ 110                               | 112                                            |
| 110 ~ 120                               | 113                                            |
| 120 ~ 130                               | 114                                            |
| 130 ~ 140                               | 115                                            |
| 140 ~ 150                               | 116                                            |
| 150 ~ 160                               | 117                                            |
| 160 ~ 170                               | 118                                            |
| 170 ~ 180                               | 119                                            |
| 180 ~ 190                               | 120                                            |
| 190 ~ 200                               | 120                                            |
| 200 ~ 210                               | 121                                            |
| 210 ~ 220                               | 122                                            |
| 220 ~ 230                               | 123                                            |
| 230 ~ 240                               | 123                                            |
| 240 ~ 250                               | 124                                            |
| 250 ~ 260                               | 125                                            |
| 260 ~ 270                               | 125                                            |
| 270 ~ 280                               | 126                                            |
| 280 ~ 290                               | 127                                            |
| 290 ~ 300                               | 127                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.00 |
| Specific Gravity $d$                                     | 3.67 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |      |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | -4.1                                                            | -4.0 | -3.9 | -3.8 | -3.8 | -3.7 | -3.5 | -3.4 | -3.3 | -3.1 | -2.8 | -2.4 |
| -60 ~ -40                                    | -4.3                                                            | -4.2 | -4.0 | -4.0 | -4.0 | -3.9 | -3.8 | -3.6 | -3.6 | -3.3 | -3.0 | -2.6 |
| -40 ~ -20                                    | -4.4                                                            | -4.2 | -4.1 | -4.0 | -4.0 | -3.9 | -3.8 | -3.6 | -3.6 | -3.4 | -3.0 | -2.6 |
| -20 ~ 0                                      | -4.4                                                            | -4.3 | -4.1 | -4.0 | -4.0 | -3.9 | -3.8 | -3.6 | -3.6 | -3.3 | -3.1 | -2.6 |
| 0 ~ 20                                       | -4.3                                                            | -4.3 | -4.1 | -4.0 | -4.0 | -3.9 | -3.8 | -3.6 | -3.6 | -3.2 | -3.0 | -2.6 |
| 20 ~ 40                                      | -4.3                                                            | -4.2 | -4.0 | -3.9 | -3.9 | -3.8 | -3.7 | -3.5 | -3.5 | -3.2 | -2.9 | -2.5 |
| 40 ~ 60                                      | -4.2                                                            | -4.1 | -3.9 | -3.9 | -3.9 | -3.8 | -3.6 | -3.3 | -3.3 | -3.1 | -2.8 | -2.4 |
| 60 ~ 80                                      | -4.1                                                            | -4.0 | -3.8 | -3.8 | -3.7 | -3.6 | -3.5 | -3.3 | -3.3 | -3.0 | -2.8 | -2.3 |
| 80 ~ 100                                     | -4.0                                                            | -3.9 | -3.7 | -3.7 | -3.6 | -3.5 | -3.4 | -3.2 | -3.2 | -2.9 | -2.7 | -2.2 |
| 100 ~ 120                                    | -4.0                                                            | -3.9 | -3.7 | -3.6 | -3.6 | -3.5 | -3.3 | -3.1 | -3.1 | -2.8 | -2.6 | -2.1 |
| 120 ~ 140                                    | -3.9                                                            | -3.8 | -3.6 | -3.5 | -3.5 | -3.4 | -3.3 | -3.1 | -3.0 | -2.7 | -2.5 | -2.0 |
| 140 ~ 160                                    | -3.9                                                            | -3.8 | -3.6 | -3.5 | -3.5 | -3.4 | -3.3 | -3.0 | -3.0 | -2.7 | -2.3 | -1.8 |
| 160 ~ 180                                    | -3.9                                                            | -3.7 | -3.5 | -3.4 | -3.4 | -3.3 | -3.2 | -2.9 | -2.9 | -2.6 | -2.3 | -1.8 |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.618 00<br>1.618 000 | Abbe Number $\nu_d$ | 63.32 | Dispersion $n_F - n_C$       | 0.009 760 |
| Refractive Index $n_e$ | 1.620 327             | Abbe Number $\nu_e$ | 63.02 | Dispersion $n_{F'} - n_{C'}$ | 0.009 843 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.589 96 |
| $n_{1970}$         | 1.970 09  | 1.595 14 |
| $n_{1530}$         | 1.529 58  | 1.600 64 |
| $n_{1129}$         | 1.128 64  | 1.605 45 |
| $n_t$              | 1.013 98  | 1.607 03 |
| $n_s$              | 0.852 11  | 1.609 77 |
| $n_{A'}$           | 0.768 19  | 1.611 64 |
| $n_F$              | 0.706 52  | 1.613 34 |
| $n_C$              | 0.656 27  | 1.615 03 |
| $n_{C'}$           | 0.643 85  | 1.615 50 |
| $n_{He-Ne}$        | 0.632 8   | 1.615 94 |
| $n_D$              | 0.589 29  | 1.617 91 |
| $n_d$              | 0.587 56  | 1.618 00 |
| $n_e$              | 0.546 07  | 1.620 33 |
| $n_F$              | 0.486 13  | 1.624 79 |
| $n_{F'}$           | 0.479 99  | 1.625 34 |
| $n_{He-Cd}$        | 0.441 57  | 1.629 38 |
| $n_g$              | 0.435 835 | 1.630 08 |
| $n_h$              | 0.404 656 | 1.634 48 |
| $n_i$              | 0.365 015 | 1.641 95 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.269 687 50E+00 |
| $A_2$                           | 3.084 181 36E-01 |
| $A_3$                           | 1.040 789 76E+00 |
| $B_1$                           | 6.216 229 49E-03 |
| $B_2$                           | 2.077 852 65E-02 |
| $B_3$                           | 1.120 512 50E+02 |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 3    |
| Weathering Resistance(Surface) Group W(S) | 1    |
| Acid Resistance(Surface) Group SR         | 51.0 |
| Phosphate Resistance PR                   | 4.0  |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 84.0  |
| Rigidity Modulus G (GPa) | 32.7  |
| Poisson's Ratio $\sigma$ | 0.285 |
| Knoop Hardness Hk[Class] | 450 5 |
| Abrasion Aa              | 313   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.007 997 |
| $n_C - n_{A'}$      | 0.003 394 |
| $n_d - n_C$         | 0.002 971 |
| $n_e - n_C$         | 0.005 298 |
| $n_g - n_d$         | 0.012 085 |
| $n_g - n_F$         | 0.005 296 |
| $n_h - n_g$         | 0.004 390 |
| $n_i - n_g$         | 0.011 862 |
| $n_{C'} - n_t$      | 0.008 469 |
| $n_e - n_{C'}$      | 0.004 826 |
| $n_{F'} - n_e$      | 0.005 017 |
| $n_i - n_{F'}$      | 0.016 603 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.819 4 |
| $\theta_{C,A'}$              | 0.347 7 |
| $\theta_{d,C}$               | 0.304 4 |
| $\theta_{e,C}$               | 0.542 8 |
| $\theta_{g,d}$               | 1.238 2 |
| $\theta_{g,F}$               | 0.542 6 |
| $\theta_{h,g}$               | 0.449 8 |
| $\theta_{i,g}$               | 1.215 4 |
| $\theta'_{C,t}$              | 0.860 4 |
| $\theta'_{e,C'}$             | 0.490 3 |
| $\theta'_{F',e}$             | 0.509 7 |
| $\theta'_{i,F'}$             | 1.686 8 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.024 4 |
| $\Delta\theta_{C,A'}$ | -0.004 9 |
| $\Delta\theta_{g,d}$  | 0.005 0  |
| $\Delta\theta_{g,F}$  | 0.003 6  |
| $\Delta\theta_{i,g}$  | 0.020 6  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 365  | $\lambda_5$      | 325 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 357  | $\lambda_{0.05}$ | 322 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.31 | 0.29             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    | 0.02             |
| 330                    | 0.17             |
| 340                    | 0.44             |
| 350                    | 0.69             |
| 360                    | 0.85             |
| 370                    | 0.924            |
| 380                    | 0.961            |
| 390                    | 0.978            |
| 400                    | 0.986            |
| 420                    | 0.991            |
| 440                    | 0.992            |
| 460                    | 0.994            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.997            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.999            |
| 1 400                  | 0.995            |
| 1 600                  | 0.991            |
| 1 800                  | 0.978            |
| 2 000                  | 0.960            |
| 2 200                  | 0.900            |
| 2 400                  | 0.85             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 539   |
| Annealing Point AP (°C)                                          | 559   |
| Transformation Temperature Tg (°C)                               | 580   |
| Yield Point At (°C)                                              | 620   |
| Softening Point SP (°C)                                          | 650   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 89    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 107   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.738 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 74                                             |
| -90 ~ -80                               | 75                                             |
| -80 ~ -70                               | 76                                             |
| -70 ~ -60                               | 78                                             |
| -60 ~ -50                               | 79                                             |
| -50 ~ -40                               | 81                                             |
| -40 ~ -30                               | 82                                             |
| -30 ~ -20                               | 83                                             |
| -20 ~ -10                               | 85                                             |
| -10 ~ 0                                 | 86                                             |
| 0 ~ 10                                  | 87                                             |
| 10 ~ 20                                 | 88                                             |
| 20 ~ 30                                 | 90                                             |
| 30 ~ 40                                 | 91                                             |
| 40 ~ 50                                 | 92                                             |
| 50 ~ 60                                 | 93                                             |
| 60 ~ 70                                 | 94                                             |
| 70 ~ 80                                 | 95                                             |
| 80 ~ 90                                 | 96                                             |
| 90 ~ 100                                | 98                                             |
| 100 ~ 110                               | 99                                             |
| 110 ~ 120                               | 100                                            |
| 120 ~ 130                               | 101                                            |
| 130 ~ 140                               | 102                                            |
| 140 ~ 150                               | 102                                            |
| 150 ~ 160                               | 103                                            |
| 160 ~ 170                               | 104                                            |
| 170 ~ 180                               | 105                                            |
| 180 ~ 190                               | 106                                            |
| 190 ~ 200                               | 107                                            |
| 200 ~ 210                               | 108                                            |
| 210 ~ 220                               | 108                                            |
| 220 ~ 230                               | 109                                            |
| 230 ~ 240                               | 110                                            |
| 240 ~ 250                               | 111                                            |
| 250 ~ 260                               | 111                                            |
| 260 ~ 270                               | 112                                            |
| 270 ~ 280                               | 113                                            |
| 280 ~ 290                               | 113                                            |
| 290 ~ 300                               | 114                                            |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 1.41 |
| Specific Gravity $d$                        | 3.51 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |     |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |     |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i   |
| -80 ~ -60                                    | -1.3                                                            | -1.2 | -1.0 | -1.0 | -0.9 | -0.8 | -0.6 | -0.4 | -0.4 | -0.2 | 0.0  | 0.5 |
| -60 ~ -40                                    | -1.6                                                            | -1.4 | -1.2 | -1.1 | -1.1 | -1.0 | -0.9 | -0.7 | -0.7 | -0.3 | -0.1 | 0.3 |
| -40 ~ -20                                    | -1.7                                                            | -1.5 | -1.3 | -1.2 | -1.2 | -1.1 | -1.0 | -0.8 | -0.7 | -0.5 | -0.1 | 0.3 |
| -20 ~ 0                                      | -1.7                                                            | -1.6 | -1.3 | -1.2 | -1.2 | -1.1 | -1.0 | -0.8 | -0.7 | -0.5 | -0.2 | 0.4 |
| 0 ~ 20                                       | -1.7                                                            | -1.6 | -1.3 | -1.3 | -1.2 | -1.1 | -1.0 | -0.8 | -0.7 | -0.4 | -0.1 | 0.4 |
| 20 ~ 40                                      | -1.6                                                            | -1.5 | -1.3 | -1.2 | -1.2 | -1.1 | -0.9 | -0.7 | -0.6 | -0.4 | 0.0  | 0.5 |
| 40 ~ 60                                      | -1.6                                                            | -1.5 | -1.2 | -1.2 | -1.0 | -1.0 | -0.9 | -0.5 | -0.5 | -0.2 | 0.1  | 0.7 |
| 60 ~ 80                                      | -1.5                                                            | -1.4 | -1.1 | -1.0 | -1.0 | -0.9 | -0.7 | -0.5 | -0.4 | -0.1 | 0.2  | 0.8 |
| 80 ~ 100                                     | -1.4                                                            | -1.3 | -1.0 | -0.9 | -0.9 | -0.8 | -0.6 | -0.3 | -0.3 | 0.0  | 0.3  | 0.9 |
| 100 ~ 120                                    | -1.4                                                            | -1.2 | -0.9 | -0.8 | -0.8 | -0.7 | -0.5 | -0.2 | -0.2 | 0.2  | 0.5  | 1.1 |
| 120 ~ 140                                    | -1.3                                                            | -1.2 | -0.9 | -0.8 | -0.7 | -0.6 | -0.4 | -0.1 | -0.1 | 0.3  | 0.6  | 1.2 |
| 140 ~ 160                                    | -1.3                                                            | -1.1 | -0.8 | -0.7 | -0.7 | -0.5 | -0.3 | 0.0  | 0.0  | 0.4  | 0.8  | 1.5 |
| 160 ~ 180                                    | -1.2                                                            | -1.0 | -0.7 | -0.6 | -0.5 | -0.4 | -0.2 | 0.1  | 0.2  | 0.5  | 0.9  | 1.6 |

## S-PHM53

Code(d) 603655

Code(e) 605651

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.603 00<br>1.603 001 | Abbe Number $\nu_d$ | 65.44 | Dispersion $n_F - n_C$       | 0.009 215 |
| Refractive Index $n_e$ | 1.605 200             | Abbe Number $\nu_e$ | 65.15 | Dispersion $n_{F'} - n_{C'}$ | 0.009 289 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.575 83 |
| $n_{1970}$         | 1.970 09  | 1.580 92 |
| $n_{1530}$         | 1.529 58  | 1.586 34 |
| $n_{1129}$         | 1.128 64  | 1.591 03 |
| $n_t$              | 1.013 98  | 1.592 56 |
| $n_s$              | 0.852 11  | 1.595 19 |
| $n_{A'}$           | 0.768 19  | 1.596 97 |
| $n_F$              | 0.706 52  | 1.598 58 |
| $n_C$              | 0.656 27  | 1.600 19 |
| $n_{C'}$           | 0.643 85  | 1.600 64 |
| $n_{He-Ne}$        | 0.632 8   | 1.601 06 |
| $n_D$              | 0.589 29  | 1.602 92 |
| $n_d$              | 0.587 56  | 1.603 00 |
| $n_e$              | 0.546 07  | 1.605 20 |
| $n_F$              | 0.486 13  | 1.609 40 |
| $n_{F'}$           | 0.479 99  | 1.609 93 |
| $n_{He-Cd}$        | 0.441 57  | 1.613 72 |
| $n_g$              | 0.435 835 | 1.614 38 |
| $n_h$              | 0.404 656 | 1.618 50 |
| $n_i$              | 0.365 015 | 1.625 47 |

| Constants of Dispersion Formula |                   |
|---------------------------------|-------------------|
| $A_1$                           | 1.097 754 23E+00  |
| $A_2$                           | 4.348 164 32E-01  |
| $A_3$                           | 1.138 949 76E+00  |
| $B_1$                           | 1.233 694 00E-02  |
| $B_2$                           | -3.725 229 03E-04 |
| $B_3$                           | 1.242 769 84E+02  |

| Chemical Properties                       |      |
|-------------------------------------------|------|
| Water Resistance(Powder) Group RW(P)      | 1    |
| Acid Resistance(Powder) Group RA(P)       | 5    |
| Weathering Resistance(Surface) Group W(S) | 1~2  |
| Acid Resistance(Surface) Group SR         | 51.0 |
| Phosphate Resistance PR                   | 4.0  |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 70.8  |   |
| Rigidity Modulus G (GPa) | 27.5  |   |
| Poisson's Ratio $\sigma$ | 0.285 |   |
| Knoop Hardness Hk[Class] | 430   | 4 |
| Abrasion Aa              | 407   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.007 630 |
| $n_C - n_{A'}$      | 0.003 223 |
| $n_d - n_C$         | 0.002 812 |
| $n_e - n_C$         | 0.005 011 |
| $n_g - n_d$         | 0.011 380 |
| $n_g - n_F$         | 0.004 977 |
| $n_h - n_g$         | 0.004 114 |
| $n_i - n_g$         | 0.011 090 |
| $n_{C'} - n_t$      | 0.008 078 |
| $n_e - n_{C'}$      | 0.004 563 |
| $n_{F'} - n_e$      | 0.004 726 |
| $n_i - n_{F'}$      | 0.015 545 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.828 0 |
| $\theta_{C,A'}$              | 0.349 8 |
| $\theta_{d,C}$               | 0.305 2 |
| $\theta_{e,C}$               | 0.543 8 |
| $\theta_{g,d}$               | 1.234 9 |
| $\theta_{g,F}$               | 0.540 1 |
| $\theta_{h,g}$               | 0.446 4 |
| $\theta_{i,g}$               | 1.203 5 |
| $\theta'_{C,t}$              | 0.869 6 |
| $\theta'_{e,C'}$             | 0.491 2 |
| $\theta'_{F',e}$             | 0.508 8 |
| $\theta'_{i,F'}$             | 1.673 5 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | -0.025 7 |
| $\Delta\theta_{C,A'}$ | -0.005 4 |
| $\Delta\theta_{g,d}$  | 0.006 1  |
| $\Delta\theta_{g,F}$  | 0.004 5  |
| $\Delta\theta_{i,g}$  | 0.026 5  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 360  | $\lambda_5$      | 300 |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 362  | $\lambda_{0.05}$ | 313 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.56 | 0.52             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    | 0.03             |
| 320                    | 0.10             |
| 330                    | 0.25             |
| 340                    | 0.45             |
| 350                    | 0.64             |
| 360                    | 0.78             |
| 370                    | 0.88             |
| 380                    | 0.935            |
| 390                    | 0.963            |
| 400                    | 0.977            |
| 420                    | 0.986            |
| 440                    | 0.987            |
| 460                    | 0.989            |
| 480                    | 0.992            |
| 500                    | 0.994            |
| 550                    | 0.998            |
| 600                    | 0.997            |
| 650                    | 0.996            |
| 700                    | 0.996            |
| 800                    | 0.997            |
| 900                    | 0.997            |
| 1 000                  | 0.996            |
| 1 200                  | 0.997            |
| 1 400                  | 0.993            |
| 1 600                  | 0.987            |
| 1 800                  | 0.967            |
| 2 000                  | 0.941            |
| 2 200                  | 0.87             |
| 2 400                  | 0.83             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | -     |
| Annealing Point AP (°C)                                          | -     |
| Transformation Temperature Tg (°C)                               | 619   |
| Yield Point At (°C)                                              | 650   |
| Softening Point SP (°C)                                          | 681   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 95    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 113   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.615 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 79                                             |
| -90 ~ -80                               | 81                                             |
| -80 ~ -70                               | 82                                             |
| -70 ~ -60                               | 84                                             |
| -60 ~ -50                               | 85                                             |
| -50 ~ -40                               | 87                                             |
| -40 ~ -30                               | 88                                             |
| -30 ~ -20                               | 90                                             |
| -20 ~ -10                               | 91                                             |
| -10 ~ 0                                 | 92                                             |
| 0 ~ 10                                  | 94                                             |
| 10 ~ 20                                 | 95                                             |
| 20 ~ 30                                 | 96                                             |
| 30 ~ 40                                 | 97                                             |
| 40 ~ 50                                 | 98                                             |
| 50 ~ 60                                 | 100                                            |
| 60 ~ 70                                 | 101                                            |
| 70 ~ 80                                 | 102                                            |
| 80 ~ 90                                 | 103                                            |
| 90 ~ 100                                | 104                                            |
| 100 ~ 110                               | 105                                            |
| 110 ~ 120                               | 106                                            |
| 120 ~ 130                               | 107                                            |
| 130 ~ 140                               | 108                                            |
| 140 ~ 150                               | 109                                            |
| 150 ~ 160                               | 110                                            |
| 160 ~ 170                               | 111                                            |
| 170 ~ 180                               | 111                                            |
| 180 ~ 190                               | 112                                            |
| 190 ~ 200                               | 113                                            |
| 200 ~ 210                               | 114                                            |
| 210 ~ 220                               | 114                                            |
| 220 ~ 230                               | 115                                            |
| 230 ~ 240                               | 116                                            |
| 240 ~ 250                               | 116                                            |
| 250 ~ 260                               | 117                                            |
| 260 ~ 270                               | 118                                            |
| 270 ~ 280                               | 118                                            |
| 280 ~ 290                               | 119                                            |
| 290 ~ 300                               | 119                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 1.21 |
| Specific Gravity $d$                                     | 3.51 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |      |      |      |      |      |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F    | F'   | g    | h    | i    |
| -80 ~ -60                                    | -3.3                                                            | -3.2 | -3.1 | -3.1 | -3.1 | -3.0 | -3.0 | -2.7 | -2.7 | -2.5 | -2.4 | -1.9 |
| -60 ~ -40                                    | -3.4                                                            | -3.4 | -3.2 | -3.1 | -3.1 | -3.0 | -3.0 | -2.8 | -2.8 | -2.6 | -2.3 | -2.0 |
| -40 ~ -20                                    | -3.4                                                            | -3.4 | -3.2 | -3.1 | -3.1 | -3.0 | -3.0 | -2.8 | -2.8 | -2.6 | -2.4 | -1.9 |
| -20 ~ 0                                      | -3.4                                                            | -3.3 | -3.2 | -3.1 | -3.0 | -3.0 | -2.9 | -2.7 | -2.7 | -2.5 | -2.3 | -1.9 |
| 0 ~ 20                                       | -3.2                                                            | -3.2 | -3.1 | -3.0 | -3.0 | -2.9 | -2.8 | -2.7 | -2.6 | -2.4 | -2.2 | -1.7 |
| 20 ~ 40                                      | -3.2                                                            | -3.1 | -3.0 | -2.9 | -2.9 | -2.8 | -2.7 | -2.6 | -2.5 | -2.3 | -2.1 | -1.6 |
| 40 ~ 60                                      | -3.1                                                            | -3.1 | -2.9 | -2.9 | -2.8 | -2.8 | -2.7 | -2.5 | -2.5 | -2.1 | -1.9 | -1.5 |
| 60 ~ 80                                      | -3.0                                                            | -3.0 | -2.8 | -2.7 | -2.7 | -2.6 | -2.5 | -2.4 | -2.3 | -2.1 | -1.9 | -1.4 |
| 80 ~ 100                                     | -2.9                                                            | -2.9 | -2.7 | -2.6 | -2.6 | -2.5 | -2.4 | -2.2 | -2.2 | -2.0 | -1.7 | -1.3 |
| 100 ~ 120                                    | -2.9                                                            | -2.8 | -2.7 | -2.6 | -2.6 | -2.5 | -2.4 | -2.2 | -2.2 | -1.9 | -1.7 | -1.2 |
| 120 ~ 140                                    | -2.9                                                            | -2.8 | -2.7 | -2.6 | -2.6 | -2.5 | -2.4 | -2.2 | -2.1 | -1.9 | -1.6 | -1.1 |
| 140 ~ 160                                    | -3.0                                                            | -2.9 | -2.7 | -2.6 | -2.6 | -2.5 | -2.4 | -2.2 | -2.2 | -1.9 | -1.6 | -1.0 |
| 160 ~ 180                                    | -3.0                                                            | -2.8 | -2.8 | -2.6 | -2.6 | -2.5 | -2.4 | -2.1 | -2.1 | -1.8 | -1.6 | -1.0 |

OHARA 25-04

## S-TIH 1

Code(d) 717295  
Code(e) 723293

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.717 36<br>1.717 362 | Abbe Number $\nu_d$ | 29.52 | Dispersion $n_F - n_C$       | 0.024 303 |
| Refractive Index $n_e$ | 1.723 098             | Abbe Number $\nu_e$ | 29.28 | Dispersion $n_{F'} - n_{C'}$ | 0.024 694 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.670 18 |
| $n_{1970}$         | 1.970 09  | 1.676 36 |
| $n_{1530}$         | 1.529 58  | 1.683 44 |
| $n_{1129}$         | 1.128 64  | 1.690 75 |
| $n_t$              | 1.013 98  | 1.693 53 |
| $n_s$              | 0.852 11  | 1.698 85 |
| $n_{A'}$           | 0.768 19  | 1.702 75 |
| $n_F$              | 0.706 52  | 1.706 49 |
| $n_C$              | 0.656 27  | 1.710 33 |
| $n_{C'}$           | 0.643 85  | 1.711 43 |
| $n_{He-Ne}$        | 0.632 8   | 1.712 46 |
| $n_D$              | 0.589 29  | 1.717 15 |
| $n_d$              | 0.587 56  | 1.717 36 |
| $n_e$              | 0.546 07  | 1.723 10 |
| $n_F$              | 0.486 13  | 1.734 63 |
| $n_{F'}$           | 0.479 99  | 1.736 12 |
| $n_{He-Cd}$        | 0.441 57  | 1.747 32 |
| $n_g$              | 0.435 835 | 1.749 33 |
| $n_h$              | 0.404 656 | 1.762 47 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.603 267 59E+00 |
| $A_2$                           | 2.429 809 35E-01 |
| $A_3$                           | 1.813 135 92E+00 |
| $B_1$                           | 1.180 191 39E-02 |
| $B_2$                           | 5.913 636 58E-02 |
| $B_3$                           | 1.612 187 47E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 88.4    |
| Rigidity Modulus G (GPa) | 35.5    |
| Poisson's Ratio $\sigma$ | 0.247   |
| Knoop Hardness Hk[Class] | 570   6 |
| Abrasion Aa              | 157     |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.016 798 |
| $n_C - n_{A'}$      | 0.007 579 |
| $n_d - n_C$         | 0.007 030 |
| $n_e - n_C$         | 0.012 766 |
| $n_g - n_d$         | 0.031 970 |
| $n_g - n_F$         | 0.014 697 |
| $n_h - n_g$         | 0.013 136 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.017 894 |
| $n_e - n_{C'}$      | 0.011 670 |
| $n_{F'} - n_e$      | 0.013 024 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.691 2 |
| $\theta_{C,A'}$              | 0.311 9 |
| $\theta_{d,C}$               | 0.289 3 |
| $\theta_{e,C}$               | 0.525 3 |
| $\theta_{g,d}$               | 1.315 5 |
| $\theta_{g,F}$               | 0.604 7 |
| $\theta_{h,g}$               | 0.540 5 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.724 6 |
| $\theta'_{e,C'}$             | 0.472 6 |
| $\theta'_{F',e}$             | 0.527 4 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.006 0 |
| $\Delta\theta_{C,A'}$ | 0.000 3 |
| $\Delta\theta_{g,d}$  | 0.012 1 |
| $\Delta\theta_{g,F}$  | 0.011 0 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 405  | $\lambda_5$      | 360 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 392  | $\lambda_{0.05}$ | 366 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.31 | 2.29             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.19             |
| 380                    | 0.56             |
| 390                    | 0.78             |
| 400                    | 0.88             |
| 420                    | 0.952            |
| 440                    | 0.971            |
| 460                    | 0.978            |
| 480                    | 0.982            |
| 500                    | 0.987            |
| 550                    | 0.994            |
| 600                    | 0.994            |
| 650                    | 0.991            |
| 700                    | 0.993            |
| 800                    | 0.998            |
| 900                    | 0.999            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.996            |
| 1 600                  | 0.995            |
| 1 800                  | 0.988            |
| 2 000                  | 0.981            |
| 2 200                  | 0.957            |
| 2 400                  | 0.941            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 569  |
| Annealing Point AP (°C)                                          | 597  |
| Transformation Temperature Tg (°C)                               | 620  |
| Yield Point At (°C)                                              | 659  |
| Softening Point SP (°C)                                          | 703  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 81   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 99   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.02 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 66                                             |
| -90 ~ -80                               | 68                                             |
| -80 ~ -70                               | 69                                             |
| -70 ~ -60                               | 71                                             |
| -60 ~ -50                               | 72                                             |
| -50 ~ -40                               | 73                                             |
| -40 ~ -30                               | 75                                             |
| -30 ~ -20                               | 76                                             |
| -20 ~ -10                               | 77                                             |
| -10 ~ 0                                 | 78                                             |
| 0 ~ 10                                  | 80                                             |
| 10 ~ 20                                 | 81                                             |
| 20 ~ 30                                 | 82                                             |
| 30 ~ 40                                 | 83                                             |
| 40 ~ 50                                 | 84                                             |
| 50 ~ 60                                 | 85                                             |
| 60 ~ 70                                 | 87                                             |
| 70 ~ 80                                 | 88                                             |
| 80 ~ 90                                 | 89                                             |
| 90 ~ 100                                | 90                                             |
| 100 ~ 110                               | 91                                             |
| 110 ~ 120                               | 92                                             |
| 120 ~ 130                               | 93                                             |
| 130 ~ 140                               | 94                                             |
| 140 ~ 150                               | 95                                             |
| 150 ~ 160                               | 96                                             |
| 160 ~ 170                               | 96                                             |
| 170 ~ 180                               | 97                                             |
| 180 ~ 190                               | 98                                             |
| 190 ~ 200                               | 99                                             |
| 200 ~ 210                               | 100                                            |
| 210 ~ 220                               | 101                                            |
| 220 ~ 230                               | 101                                            |
| 230 ~ 240                               | 102                                            |
| 240 ~ 250                               | 103                                            |
| 250 ~ 260                               | 104                                            |
| 260 ~ 270                               | 104                                            |
| 270 ~ 280                               | 105                                            |
| 280 ~ 290                               | 106                                            |
| 290 ~ 300                               | 106                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.85 |
| Specific Gravity $d$                                      | 3.06 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | -0.2                                                            | 0.1 | 0.6 | 0.8 | 0.8 | 1.2 | 1.6 | 2.4 | 2.5 | 3.6 | 5.0 | - |
| -60 ~ -40                                    | -0.1                                                            | 0.1 | 0.7 | 1.0 | 1.0 | 1.3 | 1.7 | 2.5 | 2.6 | 3.9 | 5.2 | - |
| -40 ~ -20                                    | 0.1                                                             | 0.3 | 0.9 | 1.1 | 1.1 | 1.5 | 1.8 | 2.8 | 2.9 | 4.0 | 5.5 | - |
| -20 ~ 0                                      | 0.2                                                             | 0.4 | 1.1 | 1.3 | 1.4 | 1.7 | 2.1 | 2.9 | 3.1 | 4.4 | 5.9 | - |
| 0 ~ 20                                       | 0.4                                                             | 0.7 | 1.3 | 1.5 | 1.5 | 1.9 | 2.3 | 3.2 | 3.3 | 4.6 | 6.2 | - |
| 20 ~ 40                                      | 0.6                                                             | 0.9 | 1.5 | 1.7 | 1.8 | 2.1 | 2.5 | 3.5 | 3.6 | 5.0 | 6.5 | - |
| 40 ~ 60                                      | 0.7                                                             | 1.0 | 1.6 | 1.9 | 1.9 | 2.3 | 2.7 | 3.7 | 3.8 | 5.2 | 6.8 | - |
| 60 ~ 80                                      | 0.8                                                             | 1.1 | 1.8 | 2.1 | 2.1 | 2.5 | 3.0 | 3.9 | 4.0 | 5.4 | 7.0 | - |
| 80 ~ 100                                     | 0.9                                                             | 1.2 | 1.9 | 2.1 | 2.2 | 2.6 | 3.1 | 4.1 | 4.2 | 5.6 | 7.3 | - |
| 100 ~ 120                                    | 1.0                                                             | 1.3 | 1.9 | 2.2 | 2.3 | 2.7 | 3.1 | 4.2 | 4.4 | 5.8 | 7.5 | - |
| 120 ~ 140                                    | 1.0                                                             | 1.3 | 2.0 | 2.2 | 2.3 | 2.8 | 3.2 | 4.3 | 4.4 | 5.9 | 7.6 | - |
| 140 ~ 160                                    | 0.9                                                             | 1.2 | 2.0 | 2.3 | 2.4 | 2.8 | 3.2 | 4.3 | 4.4 | 5.9 | 7.7 | - |
| 160 ~ 180                                    | 0.9                                                             | 1.2 | 1.9 | 2.2 | 2.3 | 2.7 | 3.2 | 4.2 | 4.4 | 5.9 | 7.7 | - |

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## S-TIH 3

Code(d) 740283

Code(e) 746281

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.740 00<br>1.739 998 | Abbe Number $\nu_d$ | 28.30 | Dispersion $n_F - n_C$       | 0.026 152 |
| Refractive Index $n_e$ | 1.746 167             | Abbe Number $\nu_e$ | 28.07 | Dispersion $n_{F'} - n_{C'}$ | 0.026 584 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.690 65 |
| $n_{1970}$         | 1.970 09  | 1.696 85 |
| $n_{1530}$         | 1.529 58  | 1.704 05 |
| $n_{1129}$         | 1.128 64  | 1.711 62 |
| $n_t$              | 1.013 98  | 1.714 55 |
| $n_s$              | 0.852 11  | 1.720 18 |
| $n_{A'}$           | 0.768 19  | 1.724 34 |
| $n_F$              | 0.706 52  | 1.728 33 |
| $n_C$              | 0.656 27  | 1.732 45 |
| $n_{C'}$           | 0.643 85  | 1.733 63 |
| $n_{He-Ne}$        | 0.632 8   | 1.734 74 |
| $n_D$              | 0.589 29  | 1.739 77 |
| $n_d$              | 0.587 56  | 1.740 00 |
| $n_e$              | 0.546 07  | 1.746 17 |
| $n_F$              | 0.486 13  | 1.758 61 |
| $n_{F'}$           | 0.479 99  | 1.760 21 |
| $n_{He-Cd}$        | 0.441 57  | 1.772 32 |
| $n_g$              | 0.435 835 | 1.774 50 |
| $n_h$              | 0.404 656 | 1.788 76 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.647 976 48E+00 |
| $A_2$                           | 2.672 619 17E-01 |
| $A_3$                           | 2.197 728 45E+00 |
| $B_1$                           | 1.219 176 93E-02 |
| $B_2$                           | 5.978 930 39E-02 |
| $B_3$                           | 1.921 583 40E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 90.8  |
| Rigidity Modulus G (GPa) | 36.2  |
| Poisson's Ratio $\sigma$ | 0.254 |
| Knoop Hardness Hk[Class] | 570 6 |
| Abrasion Aa              | 173   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.017 900 |
| $n_C - n_{A'}$      | 0.008 108 |
| $n_d - n_C$         | 0.007 545 |
| $n_e - n_C$         | 0.013 714 |
| $n_g - n_d$         | 0.034 504 |
| $n_g - n_F$         | 0.015 897 |
| $n_h - n_g$         | 0.014 254 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.019 075 |
| $n_e - n_{C'}$      | 0.012 539 |
| $n_{F'} - n_e$      | 0.014 045 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.684 5 |
| $\theta_{C,A'}$              | 0.310 0 |
| $\theta_{d,C}$               | 0.288 5 |
| $\theta_{e,C}$               | 0.524 4 |
| $\theta_{g,d}$               | 1.319 4 |
| $\theta_{g,F}$               | 0.607 9 |
| $\theta_{h,g}$               | 0.545 0 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.717 5 |
| $\theta'_{e,C'}$             | 0.471 7 |
| $\theta'_{F,e}$              | 0.528 3 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.005 1  |
| $\Delta\theta_{C,A'}$ | -0.000 1 |
| $\Delta\theta_{g,d}$  | 0.013 5  |
| $\Delta\theta_{g,F}$  | 0.012 2  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 420  | $\lambda_5$      | 360 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 395  | $\lambda_{0.05}$ | 367 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.81 | 2.86             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.16             |
| 380                    | 0.51             |
| 390                    | 0.74             |
| 400                    | 0.85             |
| 420                    | 0.940            |
| 440                    | 0.964            |
| 460                    | 0.975            |
| 480                    | 0.981            |
| 500                    | 0.986            |
| 550                    | 0.994            |
| 600                    | 0.994            |
| 650                    | 0.993            |
| 700                    | 0.995            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.988            |
| 2 000                  | 0.980            |
| 2 200                  | 0.955            |
| 2 400                  | 0.933            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 566  |
| Annealing Point AP (°C)                                          | 591  |
| Transformation Temperature Tg (°C)                               | 616  |
| Yield Point At (°C)                                              | 654  |
| Softening Point SP (°C)                                          | 723  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 85   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 103  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.03 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 70                                             |
| -90 ~ -80                               | 71                                             |
| -80 ~ -70                               | 72                                             |
| -70 ~ -60                               | 74                                             |
| -60 ~ -50                               | 75                                             |
| -50 ~ -40                               | 76                                             |
| -40 ~ -30                               | 78                                             |
| -30 ~ -20                               | 79                                             |
| -20 ~ -10                               | 80                                             |
| -10 ~ 0                                 | 82                                             |
| 0 ~ 10                                  | 83                                             |
| 10 ~ 20                                 | 84                                             |
| 20 ~ 30                                 | 85                                             |
| 30 ~ 40                                 | 87                                             |
| 40 ~ 50                                 | 88                                             |
| 50 ~ 60                                 | 89                                             |
| 60 ~ 70                                 | 90                                             |
| 70 ~ 80                                 | 91                                             |
| 80 ~ 90                                 | 92                                             |
| 90 ~ 100                                | 93                                             |
| 100 ~ 110                               | 94                                             |
| 110 ~ 120                               | 95                                             |
| 120 ~ 130                               | 96                                             |
| 130 ~ 140                               | 97                                             |
| 140 ~ 150                               | 98                                             |
| 150 ~ 160                               | 99                                             |
| 160 ~ 170                               | 100                                            |
| 170 ~ 180                               | 101                                            |
| 180 ~ 190                               | 102                                            |
| 190 ~ 200                               | 103                                            |
| 200 ~ 210                               | 104                                            |
| 210 ~ 220                               | 105                                            |
| 220 ~ 230                               | 105                                            |
| 230 ~ 240                               | 106                                            |
| 240 ~ 250                               | 107                                            |
| 250 ~ 260                               | 108                                            |
| 260 ~ 270                               | 108                                            |
| 270 ~ 280                               | 109                                            |
| 280 ~ 290                               | 110                                            |
| 290 ~ 300                               | 111                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.81 |
| Specific Gravity $d$                                     | 3.11 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | -0.1                                                            | 0.1 | 0.6 | 0.8 | 1.0 | 1.3 | 1.6 | 2.4 | 2.6 | 3.6 | 4.9 | - |
| -60 ~ -40                                    | -0.3                                                            | 0.0 | 0.6 | 0.8 | 0.9 | 1.2 | 1.6 | 2.5 | 2.6 | 3.7 | 5.1 | - |
| -40 ~ -20                                    | -0.3                                                            | 0.0 | 0.6 | 0.8 | 0.9 | 1.3 | 1.7 | 2.5 | 2.7 | 3.9 | 5.4 | - |
| -20 ~ 0                                      | -0.2                                                            | 0.1 | 0.7 | 0.9 | 1.0 | 1.4 | 1.8 | 2.8 | 2.9 | 4.2 | 5.7 | - |
| 0 ~ 20                                       | -0.1                                                            | 0.1 | 0.8 | 1.0 | 1.1 | 1.5 | 1.9 | 3.0 | 3.1 | 4.5 | 6.1 | - |
| 20 ~ 40                                      | 0.0                                                             | 0.3 | 1.0 | 1.2 | 1.3 | 1.7 | 2.2 | 3.2 | 3.4 | 4.8 | 6.5 | - |
| 40 ~ 60                                      | 0.1                                                             | 0.4 | 1.1 | 1.4 | 1.4 | 1.9 | 2.3 | 3.5 | 3.7 | 5.1 | 6.9 | - |
| 60 ~ 80                                      | 0.1                                                             | 0.5 | 1.3 | 1.6 | 1.7 | 2.1 | 2.6 | 3.7 | 3.9 | 5.4 | 7.3 | - |
| 80 ~ 100                                     | 0.2                                                             | 0.6 | 1.4 | 1.7 | 1.9 | 2.4 | 2.9 | 4.0 | 4.2 | 5.8 | 7.7 | - |
| 100 ~ 120                                    | 0.3                                                             | 0.7 | 1.6 | 1.9 | 1.9 | 2.4 | 3.1 | 4.3 | 4.5 | 6.1 | 8.1 | - |
| 120 ~ 140                                    | 0.4                                                             | 0.8 | 1.8 | 2.0 | 2.1 | 2.7 | 3.3 | 4.5 | 4.7 | 6.4 | 8.5 | - |
| 140 ~ 160                                    | 0.6                                                             | 1.0 | 1.9 | 2.2 | 2.3 | 2.8 | 3.4 | 4.7 | 4.9 | 6.7 | 8.9 | - |
| 160 ~ 180                                    | 0.6                                                             | 1.0 | 1.9 | 2.3 | 2.4 | 2.9 | 3.5 | 4.9 | 5.1 | 6.9 | 9.2 | - |

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## S-TIH 4

Code(d) 755275

Code(e) 762273

|                        |                       |                   |       |                              |           |
|------------------------|-----------------------|-------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.755 20<br>1.755 199 | Abbe Number $v_d$ | 27.51 | Dispersion $n_F - n_C$       | 0.027 450 |
| Refractive Index $n_e$ | 1.761 671             | Abbe Number $v_e$ | 27.29 | Dispersion $n_{F'} - n_{C'}$ | 0.027 911 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.704 30 |
| $n_{1970}$         | 1.970 09  | 1.710 54 |
| $n_{1530}$         | 1.529 58  | 1.717 84 |
| $n_{1129}$         | 1.128 64  | 1.725 61 |
| $n_t$              | 1.013 98  | 1.728 64 |
| $n_s$              | 0.852 11  | 1.734 48 |
| $n_{A'}$           | 0.768 19  | 1.738 82 |
| $n_F$              | 0.706 52  | 1.742 99 |
| $n_C$              | 0.656 27  | 1.747 30 |
| $n_{C'}$           | 0.643 85  | 1.748 53 |
| $n_{He-Ne}$        | 0.632 8   | 1.749 68 |
| $n_D$              | 0.589 29  | 1.754 96 |
| $n_d$              | 0.587 56  | 1.755 20 |
| $n_e$              | 0.546 07  | 1.761 67 |
| $n_F$              | 0.486 13  | 1.774 75 |
| $n_{F'}$           | 0.479 99  | 1.776 44 |
| $n_{He-Cd}$        | 0.441 57  | 1.789 20 |
| $n_g$              | 0.435 835 | 1.791 50 |
| $n_h$              | 0.404 656 | 1.806 56 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.667 555 31E+00 |
| $A_2$                           | 2.944 118 65E-01 |
| $A_3$                           | 2.494 221 19E+00 |
| $B_1$                           | 1.220 521 37E-02 |
| $B_2$                           | 5.977 753 29E-02 |
| $B_3$                           | 2.148 696 18E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 91.9  |
| Rigidity Modulus G (GPa) | 36.7  |
| Poisson's Ratio $\sigma$ | 0.254 |
| Knoop Hardness Hk[Class] | 570 6 |
| Abrasion Aa              | 168   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.018 659 |
| $n_C - n_{A'}$      | 0.008 473 |
| $n_d - n_C$         | 0.007 904 |
| $n_e - n_C$         | 0.014 376 |
| $n_g - n_d$         | 0.036 298 |
| $n_g - n_F$         | 0.016 752 |
| $n_h - n_g$         | 0.015 059 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.019 889 |
| $n_e - n_{C'}$      | 0.013 146 |
| $n_{F'} - n_e$      | 0.014 765 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.679 7 |
| $\theta_{C,A'}$              | 0.308 7 |
| $\theta_{d,C}$               | 0.287 9 |
| $\theta_{e,C}$               | 0.523 7 |
| $\theta_{g,d}$               | 1.322 3 |
| $\theta_{g,F}$               | 0.610 3 |
| $\theta_{h,g}$               | 0.548 6 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.712 6 |
| $\theta'_{e,C'}$             | 0.471 0 |
| $\theta'_{F,e}$              | 0.529 0 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.004 0  |
| $\Delta\theta_{C,A'}$ | -0.000 5 |
| $\Delta\theta_{g,d}$  | 0.014 7  |
| $\Delta\theta_{g,F}$  | 0.013 3  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 415  | $\lambda_5$      | 365 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 398  | $\lambda_{0.05}$ | 368 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 3.28 | 3.30             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.12             |
| 380                    | 0.45             |
| 390                    | 0.70             |
| 400                    | 0.82             |
| 420                    | 0.929            |
| 440                    | 0.962            |
| 460                    | 0.973            |
| 480                    | 0.980            |
| 500                    | 0.986            |
| 550                    | 0.995            |
| 600                    | 0.994            |
| 650                    | 0.993            |
| 700                    | 0.995            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.997            |
| 1 400                  | 0.995            |
| 1 600                  | 0.994            |
| 1 800                  | 0.987            |
| 2 000                  | 0.981            |
| 2 200                  | 0.961            |
| 2 400                  | 0.942            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 565  |
| Annealing Point AP (°C)                                          | 591  |
| Transformation Temperature Tg (°C)                               | 614  |
| Yield Point At (°C)                                              | 650  |
| Softening Point SP (°C)                                          | 694  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 86   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 105  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.01 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 70                                             |
| -90 ~ -80                               | 72                                             |
| -80 ~ -70                               | 73                                             |
| -70 ~ -60                               | 75                                             |
| -60 ~ -50                               | 76                                             |
| -50 ~ -40                               | 77                                             |
| -40 ~ -30                               | 79                                             |
| -30 ~ -20                               | 80                                             |
| -20 ~ -10                               | 82                                             |
| -10 ~ 0                                 | 83                                             |
| 0 ~ 10                                  | 84                                             |
| 10 ~ 20                                 | 86                                             |
| 20 ~ 30                                 | 87                                             |
| 30 ~ 40                                 | 88                                             |
| 40 ~ 50                                 | 89                                             |
| 50 ~ 60                                 | 91                                             |
| 60 ~ 70                                 | 92                                             |
| 70 ~ 80                                 | 93                                             |
| 80 ~ 90                                 | 94                                             |
| 90 ~ 100                                | 95                                             |
| 100 ~ 110                               | 96                                             |
| 110 ~ 120                               | 97                                             |
| 120 ~ 130                               | 99                                             |
| 130 ~ 140                               | 100                                            |
| 140 ~ 150                               | 101                                            |
| 150 ~ 160                               | 102                                            |
| 160 ~ 170                               | 103                                            |
| 170 ~ 180                               | 103                                            |
| 180 ~ 190                               | 104                                            |
| 190 ~ 200                               | 105                                            |
| 200 ~ 210                               | 106                                            |
| 210 ~ 220                               | 107                                            |
| 220 ~ 230                               | 108                                            |
| 230 ~ 240                               | 109                                            |
| 240 ~ 250                               | 109                                            |
| 250 ~ 260                               | 110                                            |
| 260 ~ 270                               | 111                                            |
| 270 ~ 280                               | 112                                            |
| 280 ~ 290                               | 112                                            |
| 290 ~ 300                               | 113                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.76 |
| Specific Gravity $d$                                      | 3.15 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t    | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | -0.4                                                            | -0.2 | 0.4 | 0.6 | 0.7 | 1.0 | 1.3 | 2.2 | 2.3 | 3.5 | 5.0 | - |
| -60 ~ -40                                    | -0.5                                                            | -0.2 | 0.4 | 0.6 | 0.6 | 1.0 | 1.3 | 2.3 | 2.4 | 3.6 | 5.2 | - |
| -40 ~ -20                                    | -0.5                                                            | -0.2 | 0.4 | 0.7 | 0.7 | 1.1 | 1.5 | 2.4 | 2.5 | 3.9 | 5.4 | - |
| -20 ~ 0                                      | -0.4                                                            | -0.1 | 0.5 | 0.7 | 0.8 | 1.2 | 1.7 | 2.6 | 2.8 | 4.1 | 5.7 | - |
| 0 ~ 20                                       | -0.3                                                            | -0.1 | 0.6 | 0.8 | 0.9 | 1.4 | 1.8 | 2.8 | 3.0 | 4.4 | 6.1 | - |
| 20 ~ 40                                      | -0.2                                                            | 0.1  | 0.8 | 1.0 | 1.1 | 1.5 | 2.0 | 3.1 | 3.3 | 4.7 | 6.6 | - |
| 40 ~ 60                                      | -0.1                                                            | 0.2  | 0.9 | 1.2 | 1.2 | 1.8 | 2.3 | 3.4 | 3.5 | 5.1 | 7.0 | - |
| 60 ~ 80                                      | 0.0                                                             | 0.3  | 1.1 | 1.4 | 1.5 | 1.9 | 2.4 | 3.6 | 3.7 | 5.4 | 7.4 | - |
| 80 ~ 100                                     | 0.0                                                             | 0.4  | 1.3 | 1.6 | 1.7 | 2.1 | 2.7 | 3.8 | 4.0 | 5.7 | 7.8 | - |
| 100 ~ 120                                    | 0.1                                                             | 0.5  | 1.3 | 1.7 | 1.8 | 2.3 | 2.9 | 4.1 | 4.3 | 6.0 | 8.2 | - |
| 120 ~ 140                                    | 0.2                                                             | 0.5  | 1.5 | 1.8 | 1.9 | 2.4 | 3.0 | 4.3 | 4.5 | 6.3 | 8.5 | - |
| 140 ~ 160                                    | 0.3                                                             | 0.7  | 1.6 | 1.9 | 2.0 | 2.5 | 3.1 | 4.4 | 4.6 | 6.5 | 8.8 | - |
| 160 ~ 180                                    | 0.3                                                             | 0.7  | 1.6 | 1.9 | 2.0 | 2.6 | 3.2 | 4.6 | 4.8 | 6.7 | 9.2 | - |

OHARA 25-04

## S-TIH 6

Code(d) 805254  
Code(e) 813252

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.805 18<br>1.805 181 | Abbe Number $\nu_d$ | 25.42 | Dispersion $n_F - n_C$       | 0.031 669 |
| Refractive Index $n_e$ | 1.812 641             | Abbe Number $\nu_e$ | 25.22 | Dispersion $n_{F'} - n_{C'}$ | 0.032 223 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.749 17 |
| $n_{1970}$         | 1.970 09  | 1.755 58 |
| $n_{1530}$         | 1.529 58  | 1.763 21 |
| $n_{1129}$         | 1.128 64  | 1.771 60 |
| $n_t$              | 1.013 98  | 1.774 95 |
| $n_s$              | 0.852 11  | 1.781 51 |
| $n_{A'}$           | 0.768 19  | 1.786 43 |
| $n_F$              | 0.706 52  | 1.791 18 |
| $n_C$              | 0.656 27  | 1.796 11 |
| $n_{C'}$           | 0.643 85  | 1.797 52 |
| $n_{He-Ne}$        | 0.632 8   | 1.798 85 |
| $n_D$              | 0.589 29  | 1.804 91 |
| $n_d$              | 0.587 56  | 1.805 18 |
| $n_e$              | 0.546 07  | 1.812 64 |
| $n_F$              | 0.486 13  | 1.827 77 |
| $n_{F'}$           | 0.479 99  | 1.829 74 |
| $n_{He-Cd}$        | 0.441 57  | 1.844 60 |
| $n_g$              | 0.435 835 | 1.847 29 |
| $n_h$              | 0.404 656 | 1.864 94 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.772 276 11E+00 |
| $A_2$                           | 3.456 912 50E-01 |
| $A_3$                           | 2.407 885 01E+00 |
| $B_1$                           | 1.311 826 33E-02 |
| $B_2$                           | 6.144 796 19E-02 |
| $B_3$                           | 2.007 532 54E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 93.1  |
| Rigidity Modulus G (GPa) | 36.9  |
| Poisson's Ratio $\sigma$ | 0.261 |
| Knoop Hardness Hk[Class] | 530 5 |
| Abrasion Aa              | 196   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.021 155 |
| $n_C - n_{A'}$      | 0.009 673 |
| $n_d - n_C$         | 0.009 075 |
| $n_e - n_C$         | 0.016 535 |
| $n_g - n_d$         | 0.042 105 |
| $n_g - n_F$         | 0.019 511 |
| $n_h - n_g$         | 0.017 653 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.022 564 |
| $n_e - n_{C'}$      | 0.015 126 |
| $n_{F'} - n_e$      | 0.017 097 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.668 0 |
| $\theta_{C,A'}$              | 0.305 4 |
| $\theta_{d,C}$               | 0.286 6 |
| $\theta_{e,C}$               | 0.522 1 |
| $\theta_{g,d}$               | 1.329 5 |
| $\theta_{g,F}$               | 0.616 1 |
| $\theta_{h,g}$               | 0.557 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.700 2 |
| $\theta'_{e,C'}$             | 0.469 4 |
| $\theta'_{F',e}$             | 0.530 6 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.002 1  |
| $\Delta\theta_{C,A'}$ | -0.001 2 |
| $\Delta\theta_{g,d}$  | 0.017 6  |
| $\Delta\theta_{g,F}$  | 0.015 8  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 440  | $\lambda_5$      | 365 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 398  | $\lambda_{0.05}$ | 368 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 3.44 | 3.56             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.12             |
| 380                    | 0.48             |
| 390                    | 0.70             |
| 400                    | 0.82             |
| 420                    | 0.919            |
| 440                    | 0.955            |
| 460                    | 0.970            |
| 480                    | 0.978            |
| 500                    | 0.984            |
| 550                    | 0.993            |
| 600                    | 0.995            |
| 650                    | 0.994            |
| 700                    | 0.996            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.997            |
| 1 600                  | 0.995            |
| 1 800                  | 0.986            |
| 2 000                  | 0.978            |
| 2 200                  | 0.958            |
| 2 400                  | 0.928            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 571  |
| Annealing Point AP (°C)                                          | 587  |
| Transformation Temperature Tg (°C)                               | 607  |
| Yield Point At (°C)                                              | 640  |
| Softening Point SP (°C)                                          | 690  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 90   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 109  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.01 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 74                                             |
| -90 ~ -80                               | 76                                             |
| -80 ~ -70                               | 77                                             |
| -70 ~ -60                               | 79                                             |
| -60 ~ -50                               | 80                                             |
| -50 ~ -40                               | 81                                             |
| -40 ~ -30                               | 83                                             |
| -30 ~ -20                               | 84                                             |
| -20 ~ -10                               | 86                                             |
| -10 ~ 0                                 | 87                                             |
| 0 ~ 10                                  | 88                                             |
| 10 ~ 20                                 | 89                                             |
| 20 ~ 30                                 | 91                                             |
| 30 ~ 40                                 | 92                                             |
| 40 ~ 50                                 | 93                                             |
| 50 ~ 60                                 | 94                                             |
| 60 ~ 70                                 | 95                                             |
| 70 ~ 80                                 | 97                                             |
| 80 ~ 90                                 | 98                                             |
| 90 ~ 100                                | 99                                             |
| 100 ~ 110                               | 100                                            |
| 110 ~ 120                               | 101                                            |
| 120 ~ 130                               | 102                                            |
| 130 ~ 140                               | 103                                            |
| 140 ~ 150                               | 104                                            |
| 150 ~ 160                               | 105                                            |
| 160 ~ 170                               | 106                                            |
| 170 ~ 180                               | 107                                            |
| 180 ~ 190                               | 108                                            |
| 190 ~ 200                               | 109                                            |
| 200 ~ 210                               | 110                                            |
| 210 ~ 220                               | 111                                            |
| 220 ~ 230                               | 112                                            |
| 230 ~ 240                               | 113                                            |
| 240 ~ 250                               | 114                                            |
| 250 ~ 260                               | 114                                            |
| 260 ~ 270                               | 115                                            |
| 270 ~ 280                               | 116                                            |
| 280 ~ 290                               | 117                                            |
| 290 ~ 300                               | 118                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.81 |
| Specific Gravity $d$                                      | 3.37 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |      |      |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |      |      |     |     |     |      |   |
|                                              | 1550                                                            | t    | r    | C    | C'   | d    | e    | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | -1.9                                                            | -1.7 | -1.1 | -0.9 | -0.8 | -0.4 | -0.1 | 0.9 | 1.1 | 2.4 | 4.1  | - |
| -60 ~ -40                                    | -2.0                                                            | -1.7 | -1.0 | -0.8 | -0.7 | -0.3 | 0.1  | 1.1 | 1.3 | 2.7 | 4.5  | - |
| -40 ~ -20                                    | -1.9                                                            | -1.6 | -0.9 | -0.7 | -0.6 | -0.1 | 0.3  | 1.4 | 1.5 | 3.0 | 5.0  | - |
| -20 ~ 0                                      | -1.8                                                            | -1.5 | -0.7 | -0.4 | -0.4 | 0.1  | 0.6  | 1.7 | 1.8 | 3.5 | 5.5  | - |
| 0 ~ 20                                       | -1.7                                                            | -1.3 | -0.5 | -0.2 | -0.2 | 0.3  | 0.8  | 2.0 | 2.2 | 4.0 | 6.1  | - |
| 20 ~ 40                                      | -1.5                                                            | -1.2 | -0.4 | 0.0  | 0.1  | 0.6  | 1.1  | 2.4 | 2.6 | 4.4 | 6.7  | - |
| 40 ~ 60                                      | -1.4                                                            | -1.0 | -0.1 | 0.2  | 0.3  | 0.8  | 1.4  | 2.7 | 2.9 | 4.8 | 7.3  | - |
| 60 ~ 80                                      | -1.2                                                            | -0.8 | 0.1  | 0.4  | 0.5  | 1.0  | 1.6  | 3.1 | 3.3 | 5.3 | 7.8  | - |
| 80 ~ 100                                     | -1.1                                                            | -0.7 | 0.3  | 0.6  | 0.7  | 1.3  | 1.9  | 3.4 | 3.6 | 5.6 | 8.3  | - |
| 100 ~ 120                                    | -1.0                                                            | -0.6 | 0.4  | 0.8  | 0.9  | 1.5  | 2.1  | 3.6 | 3.8 | 6.0 | 8.7  | - |
| 120 ~ 140                                    | -1.0                                                            | -0.5 | 0.5  | 0.9  | 1.0  | 1.6  | 2.3  | 3.9 | 4.1 | 6.3 | 9.1  | - |
| 140 ~ 160                                    | -1.0                                                            | -0.5 | 0.5  | 0.9  | 1.0  | 1.7  | 2.4  | 4.0 | 4.3 | 6.6 | 9.6  | - |
| 160 ~ 180                                    | -1.1                                                            | -0.6 | 0.5  | 0.9  | 1.1  | 1.7  | 2.5  | 4.2 | 4.5 | 6.9 | 10.0 | - |

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## S-TIH10

Code(d) 728285

Code(e) 734282

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.728 25<br>1.728 250 | Abbe Number $\nu_d$ | 28.46 | Dispersion $n_F - n_C$       | 0.025 588 |
| Refractive Index $n_e$ | 1.734 286             | Abbe Number $\nu_e$ | 28.23 | Dispersion $n_{F'} - n_{C'}$ | 0.026 009 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.679 34 |
| $n_{1970}$         | 1.970 09  | 1.685 62 |
| $n_{1530}$         | 1.529 58  | 1.692 86 |
| $n_{1129}$         | 1.128 64  | 1.700 40 |
| $n_t$              | 1.013 98  | 1.703 30 |
| $n_s$              | 0.852 11  | 1.708 84 |
| $n_{A'}$           | 0.768 19  | 1.712 92 |
| $n_F$              | 0.706 52  | 1.716 83 |
| $n_C$              | 0.656 27  | 1.720 86 |
| $n_{C'}$           | 0.643 85  | 1.722 02 |
| $n_{He-Ne}$        | 0.632 8   | 1.723 10 |
| $n_D$              | 0.589 29  | 1.728 03 |
| $n_d$              | 0.587 56  | 1.728 25 |
| $n_e$              | 0.546 07  | 1.734 29 |
| $n_F$              | 0.486 13  | 1.746 45 |
| $n_{F'}$           | 0.479 99  | 1.748 02 |
| $n_{He-Cd}$        | 0.441 57  | 1.759 87 |
| $n_g$              | 0.435 835 | 1.762 00 |
| $n_h$              | 0.404 656 | 1.775 95 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.615 493 92E+00 |
| $A_2$                           | 2.624 332 39E-01 |
| $A_3$                           | 2.094 261 89E+00 |
| $B_1$                           | 1.198 308 97E-02 |
| $B_2$                           | 5.965 102 40E-02 |
| $B_3$                           | 1.816 575 54E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 102.4 |
| Rigidity Modulus G (GPa) | 41.2  |
| Poisson's Ratio $\sigma$ | 0.243 |
| Knoop Hardness Hk[Class] | 570 6 |
| Abrasion Aa              | 158   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.017 568 |
| $n_C - n_{A'}$      | 0.007 944 |
| $n_d - n_C$         | 0.007 385 |
| $n_e - n_C$         | 0.013 421 |
| $n_g - n_d$         | 0.033 752 |
| $n_g - n_F$         | 0.015 549 |
| $n_h - n_g$         | 0.013 943 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.018 718 |
| $n_e - n_{C'}$      | 0.012 271 |
| $n_{F'} - n_e$      | 0.013 738 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.686 6 |
| $\theta_{C,A'}$              | 0.310 5 |
| $\theta_{d,C}$               | 0.288 6 |
| $\theta_{e,C}$               | 0.524 5 |
| $\theta_{g,d}$               | 1.319 1 |
| $\theta_{g,F}$               | 0.607 7 |
| $\theta_{h,g}$               | 0.544 9 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.719 7 |
| $\theta'_{e,C'}$             | 0.471 8 |
| $\theta'_{F',e}$             | 0.528 2 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.006 4 |
| $\Delta\theta_{C,A'}$ | 0.000 2 |
| $\Delta\theta_{g,d}$  | 0.013 5 |
| $\Delta\theta_{g,F}$  | 0.012 3 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 410  | $\lambda_5$      | 365 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 399  | $\lambda_{0.05}$ | 369 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 3.34 | 3.37             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.09             |
| 380                    | 0.41             |
| 390                    | 0.67             |
| 400                    | 0.81             |
| 420                    | 0.931            |
| 440                    | 0.963            |
| 460                    | 0.975            |
| 480                    | 0.982            |
| 500                    | 0.987            |
| 550                    | 0.994            |
| 600                    | 0.995            |
| 650                    | 0.993            |
| 700                    | 0.994            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.994            |
| 1 600                  | 0.993            |
| 1 800                  | 0.985            |
| 2 000                  | 0.977            |
| 2 200                  | 0.947            |
| 2 400                  | 0.929            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 569  |
| Annealing Point AP (°C)                                          | 596  |
| Transformation Temperature Tg (°C)                               | 621  |
| Yield Point At (°C)                                              | 658  |
| Softening Point SP (°C)                                          | 703  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 84   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 100  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.04 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 69                                             |
| -90 ~ -80                               | 70                                             |
| -80 ~ -70                               | 72                                             |
| -70 ~ -60                               | 73                                             |
| -60 ~ -50                               | 74                                             |
| -50 ~ -40                               | 76                                             |
| -40 ~ -30                               | 77                                             |
| -30 ~ -20                               | 78                                             |
| -20 ~ -10                               | 79                                             |
| -10 ~ 0                                 | 80                                             |
| 0 ~ 10                                  | 82                                             |
| 10 ~ 20                                 | 83                                             |
| 20 ~ 30                                 | 84                                             |
| 30 ~ 40                                 | 85                                             |
| 40 ~ 50                                 | 86                                             |
| 50 ~ 60                                 | 87                                             |
| 60 ~ 70                                 | 88                                             |
| 70 ~ 80                                 | 89                                             |
| 80 ~ 90                                 | 90                                             |
| 90 ~ 100                                | 91                                             |
| 100 ~ 110                               | 92                                             |
| 110 ~ 120                               | 93                                             |
| 120 ~ 130                               | 94                                             |
| 130 ~ 140                               | 95                                             |
| 140 ~ 150                               | 96                                             |
| 150 ~ 160                               | 97                                             |
| 160 ~ 170                               | 98                                             |
| 170 ~ 180                               | 98                                             |
| 180 ~ 190                               | 99                                             |
| 190 ~ 200                               | 100                                            |
| 200 ~ 210                               | 101                                            |
| 210 ~ 220                               | 101                                            |
| 220 ~ 230                               | 102                                            |
| 230 ~ 240                               | 103                                            |
| 240 ~ 250                               | 103                                            |
| 250 ~ 260                               | 104                                            |
| 260 ~ 270                               | 105                                            |
| 270 ~ 280                               | 105                                            |
| 280 ~ 290                               | 106                                            |
| 290 ~ 300                               | 106                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.88 |
| Specific Gravity $d$                                     | 3.06 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t    | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | -0.6                                                            | -0.3 | 0.3 | 0.5 | 0.5 | 1.0 | 1.3 | 2.2 | 2.3 | 3.6 | 5.1 | - |
| -60 ~ -40                                    | -0.3                                                            | -0.1 | 0.6 | 0.8 | 0.8 | 1.2 | 1.6 | 2.4 | 2.5 | 3.9 | 5.4 | - |
| -40 ~ -20                                    | 0.0                                                             | 0.2  | 0.8 | 1.0 | 1.1 | 1.4 | 1.9 | 2.8 | 2.9 | 4.2 | 5.8 | - |
| -20 ~ 0                                      | 0.2                                                             | 0.6  | 1.1 | 1.4 | 1.4 | 1.8 | 2.2 | 3.1 | 3.2 | 4.6 | 6.1 | - |
| 0 ~ 20                                       | 0.5                                                             | 0.8  | 1.4 | 1.6 | 1.7 | 2.1 | 2.4 | 3.5 | 3.6 | 4.9 | 6.5 | - |
| 20 ~ 40                                      | 0.8                                                             | 1.0  | 1.7 | 1.9 | 1.9 | 2.3 | 2.7 | 3.6 | 3.8 | 5.2 | 6.8 | - |
| 40 ~ 60                                      | 0.9                                                             | 1.2  | 1.8 | 2.1 | 2.1 | 2.5 | 2.9 | 3.9 | 4.1 | 5.4 | 7.0 | - |
| 60 ~ 80                                      | 1.0                                                             | 1.4  | 2.0 | 2.2 | 2.3 | 2.7 | 3.1 | 4.0 | 4.2 | 5.5 | 7.2 | - |
| 80 ~ 100                                     | 1.1                                                             | 1.4  | 2.0 | 2.2 | 2.3 | 2.8 | 3.2 | 4.1 | 4.3 | 5.6 | 7.3 | - |
| 100 ~ 120                                    | 1.1                                                             | 1.4  | 2.0 | 2.2 | 2.3 | 2.7 | 3.2 | 4.2 | 4.3 | 5.7 | 7.4 | - |
| 120 ~ 140                                    | 1.0                                                             | 1.3  | 2.0 | 2.1 | 2.2 | 2.7 | 3.1 | 4.1 | 4.2 | 5.6 | 7.3 | - |
| 140 ~ 160                                    | 0.8                                                             | 1.1  | 1.8 | 2.1 | 2.1 | 2.5 | 3.0 | 3.9 | 4.1 | 5.5 | 7.2 | - |
| 160 ~ 180                                    | 0.6                                                             | 0.9  | 1.6 | 1.8 | 1.9 | 2.3 | 2.7 | 3.7 | 3.8 | 5.2 | 6.9 | - |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.784 72<br>1.784 723 | Abbe Number $\nu_d$ | 25.68 | Dispersion $n_F - n_C$       | 0.030 554 |
| Refractive Index $n_e$ | 1.791 920             | Abbe Number $\nu_e$ | 25.47 | Dispersion $n_{F'} - n_{C'}$ | 0.031 088 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.729 98 |
| $n_{1970}$         | 1.970 09  | 1.736 39 |
| $n_{1530}$         | 1.529 58  | 1.743 97 |
| $n_{1129}$         | 1.128 64  | 1.752 22 |
| $n_t$              | 1.013 98  | 1.755 49 |
| $n_s$              | 0.852 11  | 1.761 86 |
| $n_{A'}$           | 0.768 19  | 1.766 62 |
| $n_F$              | 0.706 52  | 1.771 21 |
| $n_C$              | 0.656 27  | 1.775 96 |
| $n_{C'}$           | 0.643 85  | 1.777 33 |
| $n_{He-Ne}$        | 0.632 8   | 1.778 61 |
| $n_D$              | 0.589 29  | 1.784 46 |
| $n_d$              | 0.587 56  | 1.784 72 |
| $n_e$              | 0.546 07  | 1.791 92 |
| $n_F$              | 0.486 13  | 1.806 52 |
| $n_{F'}$           | 0.479 99  | 1.808 41 |
| $n_{He-Cd}$        | 0.441 57  | 1.822 75 |
| $n_g$              | 0.435 835 | 1.825 34 |
| $n_h$              | 0.404 656 | 1.842 39 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.726 774 71E+00 |
| $A_2$                           | 3.245 686 28E-01 |
| $A_3$                           | 2.658 168 09E+00 |
| $B_1$                           | 1.293 699 58E-02 |
| $B_2$                           | 6.182 552 45E-02 |
| $B_3$                           | 2.219 046 37E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 91.2  |
| Rigidity Modulus G (GPa) | 36.3  |
| Poisson's Ratio $\sigma$ | 0.255 |
| Knoop Hardness Hk[Class] | 560   |
| Abrasion Aa              | 180   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.020 476 |
| $n_C - n_{A'}$      | 0.009 346 |
| $n_d - n_C$         | 0.008 758 |
| $n_e - n_C$         | 0.015 955 |
| $n_g - n_d$         | 0.040 621 |
| $n_g - n_F$         | 0.018 825 |
| $n_h - n_g$         | 0.017 044 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.021 836 |
| $n_e - n_{C'}$      | 0.014 595 |
| $n_{F'} - n_e$      | 0.016 493 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.670 2 |
| $\theta_{C,A'}$              | 0.305 9 |
| $\theta_{d,C}$               | 0.286 6 |
| $\theta_{e,C}$               | 0.522 2 |
| $\theta_{g,d}$               | 1.329 5 |
| $\theta_{g,F}$               | 0.616 1 |
| $\theta_{h,g}$               | 0.557 8 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.702 4 |
| $\theta'_{e,C'}$             | 0.469 5 |
| $\theta'_{F,e}$              | 0.530 5 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.003 0  |
| $\Delta\theta_{C,A'}$ | -0.001 1 |
| $\Delta\theta_{g,d}$  | 0.018 1  |
| $\Delta\theta_{g,F}$  | 0.016 2  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 430  | $\lambda_5$      | 365 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 400  | $\lambda_{0.05}$ | 369 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 3.80 | 3.85             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.08             |
| 380                    | 0.40             |
| 390                    | 0.66             |
| 400                    | 0.80             |
| 420                    | 0.915            |
| 440                    | 0.948            |
| 460                    | 0.964            |
| 480                    | 0.973            |
| 500                    | 0.980            |
| 550                    | 0.992            |
| 600                    | 0.992            |
| 650                    | 0.990            |
| 700                    | 0.992            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.989            |
| 2 000                  | 0.982            |
| 2 200                  | 0.964            |
| 2 400                  | 0.942            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 569  |
| Annealing Point AP (°C)                                          | 588  |
| Transformation Temperature Tg (°C)                               | 608  |
| Yield Point At (°C)                                              | 639  |
| Softening Point SP (°C)                                          | 686  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 88   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 107  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.02 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 72                                             |
| -90 ~ -80                               | 74                                             |
| -80 ~ -70                               | 75                                             |
| -70 ~ -60                               | 77                                             |
| -60 ~ -50                               | 78                                             |
| -50 ~ -40                               | 79                                             |
| -40 ~ -30                               | 81                                             |
| -30 ~ -20                               | 82                                             |
| -20 ~ -10                               | 83                                             |
| -10 ~ 0                                 | 85                                             |
| 0 ~ 10                                  | 86                                             |
| 10 ~ 20                                 | 87                                             |
| 20 ~ 30                                 | 89                                             |
| 30 ~ 40                                 | 90                                             |
| 40 ~ 50                                 | 91                                             |
| 50 ~ 60                                 | 92                                             |
| 60 ~ 70                                 | 93                                             |
| 70 ~ 80                                 | 95                                             |
| 80 ~ 90                                 | 96                                             |
| 90 ~ 100                                | 97                                             |
| 100 ~ 110                               | 98                                             |
| 110 ~ 120                               | 99                                             |
| 120 ~ 130                               | 100                                            |
| 130 ~ 140                               | 101                                            |
| 140 ~ 150                               | 102                                            |
| 150 ~ 160                               | 103                                            |
| 160 ~ 170                               | 104                                            |
| 170 ~ 180                               | 105                                            |
| 180 ~ 190                               | 106                                            |
| 190 ~ 200                               | 107                                            |
| 200 ~ 210                               | 108                                            |
| 210 ~ 220                               | 109                                            |
| 220 ~ 230                               | 110                                            |
| 230 ~ 240                               | 110                                            |
| 240 ~ 250                               | 111                                            |
| 250 ~ 260                               | 112                                            |
| 260 ~ 270                               | 113                                            |
| 270 ~ 280                               | 114                                            |
| 280 ~ 290                               | 114                                            |
| 290 ~ 300                               | 115                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.81 |
| Specific Gravity $d$                                      | 3.24 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t    | r    | C    | C'   | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | -1.5                                                            | -1.2 | -0.7 | -0.5 | -0.4 | 0.0 | 0.4 | 1.3 | 1.4 | 2.8 | 4.5 | - |
| -60 ~ -40                                    | -1.4                                                            | -1.2 | -0.6 | -0.3 | -0.3 | 0.1 | 0.5 | 1.5 | 1.6 | 3.1 | 4.9 | - |
| -40 ~ -20                                    | -1.4                                                            | -1.1 | -0.5 | -0.2 | -0.2 | 0.2 | 0.6 | 1.7 | 1.9 | 3.4 | 5.3 | - |
| -20 ~ 0                                      | -1.2                                                            | -1.0 | -0.3 | 0.0  | 0.1  | 0.5 | 0.9 | 2.0 | 2.2 | 3.7 | 5.8 | - |
| 0 ~ 20                                       | -1.1                                                            | -0.8 | 0.0  | 0.2  | 0.3  | 0.7 | 1.2 | 2.3 | 2.5 | 4.2 | 6.3 | - |
| 20 ~ 40                                      | -1.0                                                            | -0.6 | 0.1  | 0.3  | 0.5  | 1.0 | 1.5 | 2.6 | 2.8 | 4.5 | 6.7 | - |
| 40 ~ 60                                      | -0.8                                                            | -0.5 | 0.4  | 0.6  | 0.7  | 1.2 | 1.7 | 2.9 | 3.1 | 4.9 | 7.1 | - |
| 60 ~ 80                                      | -0.7                                                            | -0.3 | 0.5  | 0.8  | 0.8  | 1.4 | 1.9 | 3.2 | 3.3 | 5.3 | 7.7 | - |
| 80 ~ 100                                     | -0.6                                                            | -0.2 | 0.6  | 0.9  | 1.0  | 1.6 | 2.1 | 3.4 | 3.6 | 5.6 | 8.0 | - |
| 100 ~ 120                                    | -0.6                                                            | -0.2 | 0.8  | 1.1  | 1.2  | 1.7 | 2.3 | 3.7 | 3.8 | 5.9 | 8.4 | - |
| 120 ~ 140                                    | -0.6                                                            | -0.1 | 0.8  | 1.1  | 1.2  | 1.8 | 2.4 | 3.8 | 4.0 | 6.1 | 8.7 | - |
| 140 ~ 160                                    | -0.5                                                            | -0.1 | 0.8  | 1.2  | 1.3  | 1.8 | 2.5 | 3.9 | 4.1 | 6.3 | 9.0 | - |
| 160 ~ 180                                    | -0.6                                                            | -0.2 | 0.8  | 1.1  | 1.2  | 1.8 | 2.5 | 4.0 | 4.3 | 6.5 | 9.3 | - |

## S-TIH13

Code(d) 741278

Code(e) 747276

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.740 77<br>1.740 769 | Abbe Number $\nu_d$ | 27.79 | Dispersion $n_F - n_C$       | 0.026 657 |
| Refractive Index $n_e$ | 1.747 055             | Abbe Number $\nu_e$ | 27.56 | Dispersion $n_{F'} - n_{C'}$ | 0.027 102 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.690 62 |
| $n_{1970}$         | 1.970 09  | 1.696 93 |
| $n_{1530}$         | 1.529 58  | 1.704 25 |
| $n_{1129}$         | 1.128 64  | 1.711 93 |
| $n_t$              | 1.013 98  | 1.714 90 |
| $n_s$              | 0.852 11  | 1.720 62 |
| $n_{A'}$           | 0.768 19  | 1.724 85 |
| $n_F$              | 0.706 52  | 1.728 90 |
| $n_C$              | 0.656 27  | 1.733 09 |
| $n_{C'}$           | 0.643 85  | 1.734 28 |
| $n_{He-Ne}$        | 0.632 8   | 1.735 41 |
| $n_D$              | 0.589 29  | 1.740 54 |
| $n_d$              | 0.587 56  | 1.740 77 |
| $n_e$              | 0.546 07  | 1.747 05 |
| $n_F$              | 0.486 13  | 1.759 75 |
| $n_{F'}$           | 0.479 99  | 1.761 39 |
| $n_{He-Cd}$        | 0.441 57  | 1.773 76 |
| $n_g$              | 0.435 835 | 1.775 99 |
| $n_h$              | 0.404 656 | 1.790 59 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.622 246 74E+00 |
| $A_2$                           | 2.938 445 89E-01 |
| $A_3$                           | 1.992 251 64E+00 |
| $B_1$                           | 1.183 683 86E-02 |
| $B_2$                           | 5.902 080 25E-02 |
| $B_3$                           | 1.719 599 76E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 89.9  |
| Rigidity Modulus G (GPa) | 36.0  |
| Poisson's Ratio $\sigma$ | 0.249 |
| Knoop Hardness Hk[Class] | 590 6 |
| Abrasion Aa              | 167   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.018 185 |
| $n_C - n_{A'}$      | 0.008 244 |
| $n_d - n_C$         | 0.007 680 |
| $n_e - n_C$         | 0.013 966 |
| $n_g - n_d$         | 0.035 225 |
| $n_g - n_F$         | 0.016 248 |
| $n_h - n_g$         | 0.014 593 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.019 380 |
| $n_e - n_{C'}$      | 0.012 771 |
| $n_{F'} - n_e$      | 0.014 331 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.682 2 |
| $\theta_{C,A'}$              | 0.309 3 |
| $\theta_{d,C}$               | 0.288 1 |
| $\theta_{e,C}$               | 0.523 9 |
| $\theta_{g,d}$               | 1.321 4 |
| $\theta_{g,F}$               | 0.609 5 |
| $\theta_{h,g}$               | 0.547 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.715 1 |
| $\theta'_{e,C'}$             | 0.471 2 |
| $\theta'_{F,e}$              | 0.528 8 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.005 1  |
| $\Delta\theta_{C,A'}$ | -0.000 2 |
| $\Delta\theta_{g,d}$  | 0.014 4  |
| $\Delta\theta_{g,F}$  | 0.013 0  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 415  | $\lambda_5$      | 365 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 400  | $\lambda_{0.05}$ | 368 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 3.64 | 3.67             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.08             |
| 380                    | 0.38             |
| 390                    | 0.64             |
| 400                    | 0.80             |
| 420                    | 0.921            |
| 440                    | 0.957            |
| 460                    | 0.970            |
| 480                    | 0.978            |
| 500                    | 0.984            |
| 550                    | 0.993            |
| 600                    | 0.993            |
| 650                    | 0.991            |
| 700                    | 0.994            |
| 800                    | 0.997            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.998            |
| 1 400                  | 0.994            |
| 1 600                  | 0.993            |
| 1 800                  | 0.983            |
| 2 000                  | 0.974            |
| 2 200                  | 0.944            |
| 2 400                  | 0.920            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 573  |
| Annealing Point AP (°C)                                          | 595  |
| Transformation Temperature Tg (°C)                               | 619  |
| Yield Point At (°C)                                              | 656  |
| Softening Point SP (°C)                                          | 700  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 83   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 101  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.03 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 68                                             |
| -90 ~ -80                               | 69                                             |
| -80 ~ -70                               | 71                                             |
| -70 ~ -60                               | 72                                             |
| -60 ~ -50                               | 73                                             |
| -50 ~ -40                               | 75                                             |
| -40 ~ -30                               | 76                                             |
| -30 ~ -20                               | 78                                             |
| -20 ~ -10                               | 79                                             |
| -10 ~ 0                                 | 80                                             |
| 0 ~ 10                                  | 82                                             |
| 10 ~ 20                                 | 83                                             |
| 20 ~ 30                                 | 84                                             |
| 30 ~ 40                                 | 85                                             |
| 40 ~ 50                                 | 87                                             |
| 50 ~ 60                                 | 88                                             |
| 60 ~ 70                                 | 89                                             |
| 70 ~ 80                                 | 90                                             |
| 80 ~ 90                                 | 91                                             |
| 90 ~ 100                                | 92                                             |
| 100 ~ 110                               | 93                                             |
| 110 ~ 120                               | 94                                             |
| 120 ~ 130                               | 95                                             |
| 130 ~ 140                               | 96                                             |
| 140 ~ 150                               | 97                                             |
| 150 ~ 160                               | 98                                             |
| 160 ~ 170                               | 99                                             |
| 170 ~ 180                               | 100                                            |
| 180 ~ 190                               | 101                                            |
| 190 ~ 200                               | 102                                            |
| 200 ~ 210                               | 102                                            |
| 210 ~ 220                               | 103                                            |
| 220 ~ 230                               | 104                                            |
| 230 ~ 240                               | 105                                            |
| 240 ~ 250                               | 105                                            |
| 250 ~ 260                               | 106                                            |
| 260 ~ 270                               | 107                                            |
| 270 ~ 280                               | 107                                            |
| 280 ~ 290                               | 108                                            |
| 290 ~ 300                               | 108                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.83 |
| Specific Gravity $d$                                     | 3.10 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | 0.0                                                             | 0.2 | 0.7 | 0.8 | 1.0 | 1.3 | 1.6 | 2.4 | 2.6 | 3.7 | 5.1 | - |
| -60 ~ -40                                    | -0.1                                                            | 0.1 | 0.7 | 0.9 | 1.0 | 1.3 | 1.6 | 2.5 | 2.6 | 3.8 | 5.3 | - |
| -40 ~ -20                                    | 0.0                                                             | 0.2 | 0.7 | 0.9 | 1.0 | 1.4 | 1.8 | 2.7 | 2.8 | 4.0 | 5.7 | - |
| -20 ~ 0                                      | 0.1                                                             | 0.4 | 0.9 | 1.1 | 1.2 | 1.6 | 2.0 | 3.0 | 3.1 | 4.4 | 6.1 | - |
| 0 ~ 20                                       | 0.2                                                             | 0.5 | 1.1 | 1.3 | 1.4 | 1.7 | 2.2 | 3.2 | 3.3 | 4.7 | 6.5 | - |
| 20 ~ 40                                      | 0.3                                                             | 0.6 | 1.3 | 1.5 | 1.6 | 2.0 | 2.4 | 3.4 | 3.5 | 5.1 | 6.9 | - |
| 40 ~ 60                                      | 0.4                                                             | 0.7 | 1.4 | 1.7 | 1.7 | 2.2 | 2.6 | 3.8 | 3.9 | 5.4 | 7.3 | - |
| 60 ~ 80                                      | 0.5                                                             | 0.9 | 1.6 | 1.9 | 2.0 | 2.4 | 2.9 | 4.0 | 4.1 | 5.7 | 7.7 | - |
| 80 ~ 100                                     | 0.6                                                             | 1.0 | 1.7 | 2.0 | 2.1 | 2.6 | 3.1 | 4.2 | 4.4 | 6.0 | 8.1 | - |
| 100 ~ 120                                    | 0.7                                                             | 1.1 | 1.8 | 2.1 | 2.2 | 2.7 | 3.3 | 4.5 | 4.6 | 6.3 | 8.5 | - |
| 120 ~ 140                                    | 0.7                                                             | 1.1 | 2.0 | 2.3 | 2.4 | 2.9 | 3.4 | 4.6 | 4.8 | 6.6 | 8.8 | - |
| 140 ~ 160                                    | 0.8                                                             | 1.2 | 2.0 | 2.3 | 2.4 | 2.9 | 3.5 | 4.8 | 4.9 | 6.8 | 9.1 | - |
| 160 ~ 180                                    | 0.8                                                             | 1.2 | 2.0 | 2.3 | 2.4 | 2.9 | 3.5 | 4.8 | 5.0 | 6.9 | 9.3 | - |

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## S-TIH14

Code(d) 762265

Code(e) 769263

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.761 82<br>1.761 821 | Abbe Number $\nu_d$ | 26.52 | Dispersion $n_F - n_C$       | 0.028 729 |
| Refractive Index $n_e$ | 1.768 591             | Abbe Number $\nu_e$ | 26.30 | Dispersion $n_{F'} - n_{C'}$ | 0.029 221 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.709 16 |
| $n_{1970}$         | 1.970 09  | 1.715 54 |
| $n_{1530}$         | 1.529 58  | 1.723 02 |
| $n_{1129}$         | 1.128 64  | 1.731 02 |
| $n_t$              | 1.013 98  | 1.734 15 |
| $n_s$              | 0.852 11  | 1.740 22 |
| $n_{A'}$           | 0.768 19  | 1.744 74 |
| $n_F$              | 0.706 52  | 1.749 08 |
| $n_C$              | 0.656 27  | 1.753 57 |
| $n_{C'}$           | 0.643 85  | 1.754 85 |
| $n_{He-Ne}$        | 0.632 8   | 1.756 06 |
| $n_D$              | 0.589 29  | 1.761 57 |
| $n_d$              | 0.587 56  | 1.761 82 |
| $n_e$              | 0.546 07  | 1.768 59 |
| $n_F$              | 0.486 13  | 1.782 30 |
| $n_{F'}$           | 0.479 99  | 1.784 07 |
| $n_{He-Cd}$        | 0.441 57  | 1.797 50 |
| $n_g$              | 0.435 835 | 1.799 92 |
| $n_h$              | 0.404 656 | 1.815 84 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.689 151 08E+00 |
| $A_2$                           | 2.904 620 24E-01 |
| $A_3$                           | 2.379 715 16E+00 |
| $B_1$                           | 1.282 025 14E-02 |
| $B_2$                           | 6.180 908 41E-02 |
| $B_3$                           | 2.010 943 52E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 88.8  |
| Rigidity Modulus G (GPa) | 35.4  |
| Poisson's Ratio $\sigma$ | 0.254 |
| Knoop Hardness Hk[Class] | 550   |
| Abrasion Aa              | 171   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.019 413 |
| $n_C - n_{A'}$      | 0.008 831 |
| $n_d - n_C$         | 0.008 254 |
| $n_e - n_C$         | 0.015 024 |
| $n_g - n_d$         | 0.038 102 |
| $n_g - n_F$         | 0.017 627 |
| $n_h - n_g$         | 0.015 917 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.020 697 |
| $n_e - n_{C'}$      | 0.013 740 |
| $n_{F'} - n_e$      | 0.015 481 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.675 7 |
| $\theta_{C,A'}$              | 0.307 4 |
| $\theta_{d,C}$               | 0.287 3 |
| $\theta_{e,C}$               | 0.523 0 |
| $\theta_{g,d}$               | 1.326 3 |
| $\theta_{g,F}$               | 0.613 6 |
| $\theta_{h,g}$               | 0.554 0 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.708 3 |
| $\theta'_{e,C'}$             | 0.470 2 |
| $\theta'_{F,e}$              | 0.529 8 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.004 6  |
| $\Delta\theta_{C,A'}$ | -0.000 6 |
| $\Delta\theta_{g,d}$  | 0.016 7  |
| $\Delta\theta_{g,F}$  | 0.015 0  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 420  | $\lambda_5$      | 365 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 397  | $\lambda_{0.05}$ | 368 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 3.11 | 3.10             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.10             |
| 380                    | 0.43             |
| 390                    | 0.70             |
| 400                    | 0.84             |
| 420                    | 0.934            |
| 440                    | 0.960            |
| 460                    | 0.971            |
| 480                    | 0.977            |
| 500                    | 0.983            |
| 550                    | 0.993            |
| 600                    | 0.993            |
| 650                    | 0.990            |
| 700                    | 0.992            |
| 800                    | 0.997            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.997            |
| 1 600                  | 0.996            |
| 1 800                  | 0.988            |
| 2 000                  | 0.982            |
| 2 200                  | 0.961            |
| 2 400                  | 0.942            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 565  |
| Annealing Point AP (°C)                                          | 590  |
| Transformation Temperature Tg (°C)                               | 616  |
| Yield Point At (°C)                                              | 649  |
| Softening Point SP (°C)                                          | 693  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 86   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 104  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.03 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 71                                             |
| -90 ~ -80                               | 72                                             |
| -80 ~ -70                               | 74                                             |
| -70 ~ -60                               | 75                                             |
| -60 ~ -50                               | 76                                             |
| -50 ~ -40                               | 78                                             |
| -40 ~ -30                               | 79                                             |
| -30 ~ -20                               | 80                                             |
| -20 ~ -10                               | 82                                             |
| -10 ~ 0                                 | 83                                             |
| 0 ~ 10                                  | 84                                             |
| 10 ~ 20                                 | 85                                             |
| 20 ~ 30                                 | 87                                             |
| 30 ~ 40                                 | 88                                             |
| 40 ~ 50                                 | 89                                             |
| 50 ~ 60                                 | 90                                             |
| 60 ~ 70                                 | 91                                             |
| 70 ~ 80                                 | 92                                             |
| 80 ~ 90                                 | 93                                             |
| 90 ~ 100                                | 95                                             |
| 100 ~ 110                               | 96                                             |
| 110 ~ 120                               | 97                                             |
| 120 ~ 130                               | 98                                             |
| 130 ~ 140                               | 99                                             |
| 140 ~ 150                               | 100                                            |
| 150 ~ 160                               | 101                                            |
| 160 ~ 170                               | 102                                            |
| 170 ~ 180                               | 103                                            |
| 180 ~ 190                               | 104                                            |
| 190 ~ 200                               | 104                                            |
| 200 ~ 210                               | 105                                            |
| 210 ~ 220                               | 106                                            |
| 220 ~ 230                               | 107                                            |
| 230 ~ 240                               | 108                                            |
| 240 ~ 250                               | 109                                            |
| 250 ~ 260                               | 110                                            |
| 260 ~ 270                               | 110                                            |
| 270 ~ 280                               | 111                                            |
| 280 ~ 290                               | 112                                            |
| 290 ~ 300                               | 113                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.86 |
| Specific Gravity $d$                                      | 3.17 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t    | r    | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | -1.0                                                            | -0.8 | -0.2 | 0.0 | 0.0 | 0.4 | 0.7 | 1.6 | 1.8 | 3.0 | 4.6 | - |
| -60 ~ -40                                    | -1.0                                                            | -0.7 | -0.2 | 0.0 | 0.1 | 0.4 | 0.9 | 1.8 | 1.9 | 3.2 | 5.0 | - |
| -40 ~ -20                                    | -0.9                                                            | -0.7 | 0.0  | 0.2 | 0.3 | 0.6 | 1.0 | 2.0 | 2.1 | 3.6 | 5.3 | - |
| -20 ~ 0                                      | -0.8                                                            | -0.5 | 0.1  | 0.3 | 0.4 | 0.8 | 1.3 | 2.3 | 2.5 | 3.9 | 5.8 | - |
| 0 ~ 20                                       | -0.7                                                            | -0.4 | 0.3  | 0.6 | 0.6 | 1.1 | 1.6 | 2.6 | 2.8 | 4.3 | 6.4 | - |
| 20 ~ 40                                      | -0.5                                                            | -0.2 | 0.5  | 0.8 | 0.8 | 1.3 | 1.8 | 3.0 | 3.1 | 4.8 | 6.8 | - |
| 40 ~ 60                                      | -0.4                                                            | 0.0  | 0.7  | 1.0 | 1.0 | 1.6 | 2.1 | 3.3 | 3.4 | 5.2 | 7.3 | - |
| 60 ~ 80                                      | -0.2                                                            | 0.2  | 0.9  | 1.2 | 1.3 | 1.8 | 2.3 | 3.5 | 3.7 | 5.5 | 7.9 | - |
| 80 ~ 100                                     | -0.2                                                            | 0.2  | 1.0  | 1.4 | 1.5 | 2.0 | 2.6 | 3.8 | 4.0 | 5.9 | 8.2 | - |
| 100 ~ 120                                    | -0.1                                                            | 0.3  | 1.1  | 1.6 | 1.6 | 2.2 | 2.8 | 4.1 | 4.3 | 6.2 | 8.7 | - |
| 120 ~ 140                                    | 0.0                                                             | 0.4  | 1.3  | 1.7 | 1.8 | 2.3 | 2.9 | 4.3 | 4.5 | 6.5 | 9.1 | - |
| 140 ~ 160                                    | 0.1                                                             | 0.5  | 1.4  | 1.7 | 1.8 | 2.4 | 3.0 | 4.5 | 4.7 | 6.8 | 9.4 | - |
| 160 ~ 180                                    | 0.0                                                             | 0.4  | 1.4  | 1.7 | 1.8 | 2.4 | 3.1 | 4.6 | 4.8 | 7.0 | 9.8 | - |

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## S-TIH18

Code(d) 722292

Code(e) 727290

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.721 51<br>1.721 507 | Abbe Number $\nu_d$ | 29.23 | Dispersion $n_F - n_C$       | 0.024 683 |
| Refractive Index $n_e$ | 1.727 331             | Abbe Number $\nu_e$ | 29.00 | Dispersion $n_{F'} - n_{C'}$ | 0.025 081 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.673 84 |
| $n_{1970}$         | 1.970 09  | 1.680 02 |
| $n_{1530}$         | 1.529 58  | 1.687 15 |
| $n_{1129}$         | 1.128 64  | 1.694 53 |
| $n_t$              | 1.013 98  | 1.697 34 |
| $n_s$              | 0.852 11  | 1.702 72 |
| $n_{A'}$           | 0.768 19  | 1.706 68 |
| $n_F$              | 0.706 52  | 1.710 47 |
| $n_C$              | 0.656 27  | 1.714 37 |
| $n_{C'}$           | 0.643 85  | 1.715 48 |
| $n_{He-Ne}$        | 0.632 8   | 1.716 53 |
| $n_D$              | 0.589 29  | 1.721 29 |
| $n_d$              | 0.587 56  | 1.721 51 |
| $n_e$              | 0.546 07  | 1.727 33 |
| $n_F$              | 0.486 13  | 1.739 05 |
| $n_{F'}$           | 0.479 99  | 1.740 57 |
| $n_{He-Cd}$        | 0.441 57  | 1.751 95 |
| $n_g$              | 0.435 835 | 1.753 99 |
| $n_h$              | 0.404 656 | 1.767 35 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.599 216 08E+00 |
| $A_2$                           | 2.595 321 64E-01 |
| $A_3$                           | 2.124 545 43E+00 |
| $B_1$                           | 1.164 693 04E-02 |
| $B_2$                           | 5.848 248 83E-02 |
| $B_3$                           | 1.869 277 79E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 89.1  |
| Rigidity Modulus G (GPa) | 35.7  |
| Poisson's Ratio $\sigma$ | 0.248 |
| Knoop Hardness Hk[Class] | 560 6 |
| Abrasion Aa              | 160   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.017 028 |
| $n_C - n_{A'}$      | 0.007 687 |
| $n_d - n_C$         | 0.007 136 |
| $n_e - n_C$         | 0.012 960 |
| $n_g - n_d$         | 0.032 488 |
| $n_g - n_F$         | 0.014 941 |
| $n_h - n_g$         | 0.013 358 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.018 141 |
| $n_e - n_{C'}$      | 0.011 847 |
| $n_{F'} - n_e$      | 0.013 234 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.689 9 |
| $\theta_{C,A'}$              | 0.311 4 |
| $\theta_{d,C}$               | 0.289 1 |
| $\theta_{e,C}$               | 0.525 1 |
| $\theta_{g,d}$               | 1.316 2 |
| $\theta_{g,F}$               | 0.605 3 |
| $\theta_{h,g}$               | 0.541 2 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.723 3 |
| $\theta'_{e,C'}$             | 0.472 3 |
| $\theta'_{F',e}$             | 0.527 7 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.006 1 |
| $\Delta\theta_{C,A'}$ | 0.000 1 |
| $\Delta\theta_{g,d}$  | 0.012 2 |
| $\Delta\theta_{g,F}$  | 0.011 1 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 410  | $\lambda_5$      | 360 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 393  | $\lambda_{0.05}$ | 366 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.43 | 2.44             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.18             |
| 380                    | 0.54             |
| 390                    | 0.77             |
| 400                    | 0.87             |
| 420                    | 0.951            |
| 440                    | 0.971            |
| 460                    | 0.979            |
| 480                    | 0.984            |
| 500                    | 0.988            |
| 550                    | 0.995            |
| 600                    | 0.995            |
| 650                    | 0.993            |
| 700                    | 0.995            |
| 800                    | 0.998            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.996            |
| 1 600                  | 0.995            |
| 1 800                  | 0.986            |
| 2 000                  | 0.978            |
| 2 200                  | 0.948            |
| 2 400                  | 0.928            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 570  |
| Annealing Point AP (°C)                                          | 596  |
| Transformation Temperature Tg (°C)                               | 622  |
| Yield Point At (°C)                                              | 660  |
| Softening Point SP (°C)                                          | 703  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 85   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 100  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.03 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 68                                             |
| -90 ~ -80                               | 70                                             |
| -80 ~ -70                               | 72                                             |
| -70 ~ -60                               | 73                                             |
| -60 ~ -50                               | 75                                             |
| -50 ~ -40                               | 76                                             |
| -40 ~ -30                               | 77                                             |
| -30 ~ -20                               | 79                                             |
| -20 ~ -10                               | 80                                             |
| -10 ~ 0                                 | 81                                             |
| 0 ~ 10                                  | 83                                             |
| 10 ~ 20                                 | 84                                             |
| 20 ~ 30                                 | 85                                             |
| 30 ~ 40                                 | 86                                             |
| 40 ~ 50                                 | 87                                             |
| 50 ~ 60                                 | 88                                             |
| 60 ~ 70                                 | 90                                             |
| 70 ~ 80                                 | 91                                             |
| 80 ~ 90                                 | 92                                             |
| 90 ~ 100                                | 93                                             |
| 100 ~ 110                               | 94                                             |
| 110 ~ 120                               | 94                                             |
| 120 ~ 130                               | 95                                             |
| 130 ~ 140                               | 96                                             |
| 140 ~ 150                               | 97                                             |
| 150 ~ 160                               | 98                                             |
| 160 ~ 170                               | 98                                             |
| 170 ~ 180                               | 99                                             |
| 180 ~ 190                               | 100                                            |
| 190 ~ 200                               | 101                                            |
| 200 ~ 210                               | 101                                            |
| 210 ~ 220                               | 102                                            |
| 220 ~ 230                               | 102                                            |
| 230 ~ 240                               | 103                                            |
| 240 ~ 250                               | 103                                            |
| 250 ~ 260                               | 104                                            |
| 260 ~ 270                               | 104                                            |
| 270 ~ 280                               | 105                                            |
| 280 ~ 290                               | 105                                            |
| 290 ~ 300                               | 105                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.87 |
| Specific Gravity $d$                                     | 3.07 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | -0.2                                                            | 0.1 | 0.6 | 0.8 | 0.9 | 1.3 | 1.6 | 2.3 | 2.4 | 3.6 | 4.9 | - |
| -60 ~ -40                                    | 0.0                                                             | 0.2 | 0.7 | 1.0 | 1.0 | 1.4 | 1.7 | 2.5 | 2.6 | 3.8 | 5.2 | - |
| -40 ~ -20                                    | 0.1                                                             | 0.4 | 0.9 | 1.1 | 1.2 | 1.5 | 1.9 | 2.8 | 2.9 | 4.1 | 5.5 | - |
| -20 ~ 0                                      | 0.2                                                             | 0.5 | 1.1 | 1.3 | 1.4 | 1.8 | 2.1 | 3.0 | 3.1 | 4.4 | 5.9 | - |
| 0 ~ 20                                       | 0.5                                                             | 0.7 | 1.3 | 1.5 | 1.6 | 2.0 | 2.4 | 3.3 | 3.4 | 4.8 | 6.3 | - |
| 20 ~ 40                                      | 0.6                                                             | 0.9 | 1.5 | 1.8 | 1.8 | 2.2 | 2.6 | 3.6 | 3.7 | 5.1 | 6.7 | - |
| 40 ~ 60                                      | 0.8                                                             | 1.0 | 1.7 | 1.9 | 2.0 | 2.4 | 2.8 | 3.8 | 3.9 | 5.4 | 7.0 | - |
| 60 ~ 80                                      | 0.8                                                             | 1.1 | 1.9 | 2.1 | 2.2 | 2.6 | 3.1 | 4.0 | 4.2 | 5.6 | 7.3 | - |
| 80 ~ 100                                     | 0.9                                                             | 1.2 | 1.9 | 2.2 | 2.2 | 2.8 | 3.2 | 4.3 | 4.4 | 5.9 | 7.6 | - |
| 100 ~ 120                                    | 0.9                                                             | 1.3 | 2.0 | 2.2 | 2.3 | 2.8 | 3.2 | 4.4 | 4.5 | 6.1 | 7.9 | - |
| 120 ~ 140                                    | 0.9                                                             | 1.3 | 2.0 | 2.3 | 2.4 | 2.8 | 3.3 | 4.5 | 4.6 | 6.2 | 8.1 | - |
| 140 ~ 160                                    | 0.8                                                             | 1.2 | 2.1 | 2.3 | 2.4 | 2.9 | 3.4 | 4.5 | 4.7 | 6.3 | 8.2 | - |
| 160 ~ 180                                    | 0.8                                                             | 1.2 | 1.9 | 2.2 | 2.3 | 2.8 | 3.3 | 4.5 | 4.6 | 6.3 | 8.2 | - |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.846 66<br>1.846 660 | Abbe Number $\nu_d$ | 23.78 | Dispersion $n_F - n_C$       | 0.035 608 |
| Refractive Index $n_e$ | 1.855 041             | Abbe Number $\nu_e$ | 23.59 | Dispersion $n_{F'} - n_{C'}$ | 0.036 247 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.785 19 |
| $n_{1970}$         | 1.970 09  | 1.791 99 |
| $n_{1530}$         | 1.529 58  | 1.800 13 |
| $n_{1129}$         | 1.128 64  | 1.809 25 |
| $n_t$              | 1.013 98  | 1.812 94 |
| $n_s$              | 0.852 11  | 1.820 21 |
| $n_{A'}$           | 0.768 19  | 1.825 68 |
| $n_F$              | 0.706 52  | 1.830 98 |
| $n_C$              | 0.656 27  | 1.836 49 |
| $n_{C'}$           | 0.643 85  | 1.838 07 |
| $n_{He-Ne}$        | 0.632 8   | 1.839 56 |
| $n_D$              | 0.589 29  | 1.846 35 |
| $n_d$              | 0.587 56  | 1.846 66 |
| $n_e$              | 0.546 07  | 1.855 04 |
| $n_F$              | 0.486 13  | 1.872 10 |
| $n_{F'}$           | 0.479 99  | 1.874 31 |
| $n_{He-Cd}$        | 0.441 57  | 1.891 14 |
| $n_g$              | 0.435 835 | 1.894 19 |
| $n_h$              | 0.404 656 | 1.914 29 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.879 048 86E+00 |
| $A_2$                           | 3.697 197 75E-01 |
| $A_3$                           | 2.337 308 63E+00 |
| $B_1$                           | 1.441 217 70E-02 |
| $B_2$                           | 6.388 179 90E-02 |
| $B_3$                           | 1.826 681 80E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 96.0  |   |
| Rigidity Modulus G (GPa) | 37.9  |   |
| Poisson's Ratio $\sigma$ | 0.266 |   |
| Knoop Hardness Hk[Class] | 530   | 5 |
| Abrasion Aa              | 188   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.023 550 |
| $n_C - n_{A'}$      | 0.010 806 |
| $n_d - n_C$         | 0.010 172 |
| $n_e - n_C$         | 0.018 553 |
| $n_g - n_d$         | 0.047 529 |
| $n_g - n_F$         | 0.022 093 |
| $n_h - n_g$         | 0.020 105 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.025 128 |
| $n_e - n_{C'}$      | 0.016 975 |
| $n_{F'} - n_e$      | 0.019 272 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.661 4 |
| $\theta_{C,A'}$              | 0.303 5 |
| $\theta_{d,C}$               | 0.285 7 |
| $\theta_{e,C}$               | 0.521 0 |
| $\theta_{g,d}$               | 1.334 8 |
| $\theta_{g,F}$               | 0.620 5 |
| $\theta_{h,g}$               | 0.564 6 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.693 2 |
| $\theta'_{e,C'}$             | 0.468 3 |
| $\theta'_{F,e}$              | 0.531 7 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.003 2  |
| $\Delta\theta_{C,A'}$ | -0.001 2 |
| $\Delta\theta_{g,d}$  | 0.019 5  |
| $\Delta\theta_{g,F}$  | 0.017 5  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 370 |
| $\lambda_{70}$        | 420  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 408  | $\lambda_{0.05}$ | 370 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 4.97 | 5.06             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.06             |
| 380                    | 0.35             |
| 390                    | 0.61             |
| 400                    | 0.75             |
| 420                    | 0.87             |
| 440                    | 0.927            |
| 460                    | 0.948            |
| 480                    | 0.961            |
| 500                    | 0.971            |
| 550                    | 0.987            |
| 600                    | 0.989            |
| 650                    | 0.985            |
| 700                    | 0.989            |
| 800                    | 0.997            |
| 900                    | 0.998            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.998            |
| 1 600                  | 0.997            |
| 1 800                  | 0.991            |
| 2 000                  | 0.986            |
| 2 200                  | 0.974            |
| 2 400                  | 0.955            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 576  |
| Annealing Point AP (°C)                                          | 596  |
| Transformation Temperature Tg (°C)                               | 630  |
| Yield Point At (°C)                                              | 663  |
| Softening Point SP (°C)                                          | 692  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 88   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 104  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.00 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 72                                             |
| -90 ~ -80                               | 74                                             |
| -80 ~ -70                               | 75                                             |
| -70 ~ -60                               | 77                                             |
| -60 ~ -50                               | 78                                             |
| -50 ~ -40                               | 80                                             |
| -40 ~ -30                               | 81                                             |
| -30 ~ -20                               | 82                                             |
| -20 ~ -10                               | 83                                             |
| -10 ~ 0                                 | 85                                             |
| 0 ~ 10                                  | 86                                             |
| 10 ~ 20                                 | 87                                             |
| 20 ~ 30                                 | 88                                             |
| 30 ~ 40                                 | 90                                             |
| 40 ~ 50                                 | 91                                             |
| 50 ~ 60                                 | 92                                             |
| 60 ~ 70                                 | 93                                             |
| 70 ~ 80                                 | 94                                             |
| 80 ~ 90                                 | 95                                             |
| 90 ~ 100                                | 96                                             |
| 100 ~ 110                               | 97                                             |
| 110 ~ 120                               | 98                                             |
| 120 ~ 130                               | 99                                             |
| 130 ~ 140                               | 99                                             |
| 140 ~ 150                               | 100                                            |
| 150 ~ 160                               | 101                                            |
| 160 ~ 170                               | 102                                            |
| 170 ~ 180                               | 103                                            |
| 180 ~ 190                               | 103                                            |
| 190 ~ 200                               | 104                                            |
| 200 ~ 210                               | 105                                            |
| 210 ~ 220                               | 105                                            |
| 220 ~ 230                               | 106                                            |
| 230 ~ 240                               | 107                                            |
| 240 ~ 250                               | 107                                            |
| 250 ~ 260                               | 108                                            |
| 260 ~ 270                               | 108                                            |
| 270 ~ 280                               | 109                                            |
| 280 ~ 290                               | 109                                            |
| 290 ~ 300                               | 110                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.81 |
| Specific Gravity $d$                                     | 3.54 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t    | r    | C    | C'   | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | -1.4                                                            | -1.1 | -0.6 | -0.2 | -0.2 | 0.2 | 0.6 | 1.6 | 1.8 | 3.2 | 5.0  | - |
| -60 ~ -40                                    | -1.6                                                            | -1.3 | -0.7 | -0.3 | -0.3 | 0.1 | 0.6 | 1.6 | 1.8 | 3.4 | 5.3  | - |
| -40 ~ -20                                    | -1.7                                                            | -1.4 | -0.6 | -0.3 | -0.3 | 0.2 | 0.7 | 1.9 | 2.1 | 3.7 | 5.9  | - |
| -20 ~ 0                                      | -1.6                                                            | -1.3 | -0.6 | -0.3 | -0.2 | 0.3 | 0.9 | 2.1 | 2.3 | 4.1 | 6.5  | - |
| 0 ~ 20                                       | -1.6                                                            | -1.2 | -0.4 | -0.1 | 0.0  | 0.5 | 1.2 | 2.5 | 2.7 | 4.6 | 7.1  | - |
| 20 ~ 40                                      | -1.5                                                            | -1.1 | -0.2 | 0.1  | 0.2  | 0.8 | 1.4 | 2.8 | 3.1 | 5.2 | 7.8  | - |
| 40 ~ 60                                      | -1.4                                                            | -1.0 | 0.0  | 0.3  | 0.4  | 1.0 | 1.7 | 3.3 | 3.5 | 5.7 | 8.5  | - |
| 60 ~ 80                                      | -1.3                                                            | -0.9 | 0.2  | 0.5  | 0.6  | 1.4 | 2.1 | 3.7 | 3.9 | 6.2 | 9.2  | - |
| 80 ~ 100                                     | -1.1                                                            | -0.6 | 0.4  | 0.8  | 0.9  | 1.6 | 2.3 | 4.1 | 4.4 | 6.8 | 9.9  | - |
| 100 ~ 120                                    | -1.0                                                            | -0.5 | 0.7  | 1.1  | 1.2  | 1.9 | 2.7 | 4.5 | 4.7 | 7.3 | 10.7 | - |
| 120 ~ 140                                    | -0.8                                                            | -0.3 | 0.9  | 1.3  | 1.5  | 2.2 | 3.0 | 4.9 | 5.2 | 7.9 | 11.4 | - |
| 140 ~ 160                                    | -0.7                                                            | -0.2 | 1.1  | 1.6  | 1.7  | 2.5 | 3.3 | 5.3 | 5.6 | 8.6 | 12.1 | - |
| 160 ~ 180                                    | -0.6                                                            | 0.0  | 1.3  | 1.9  | 2.0  | 2.8 | 3.7 | 5.8 | 6.1 | 9.1 | 12.8 | - |

## S-TIH53W

Code(d) 847238

Code(e) 855236

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.846 66<br>1.846 660 | Abbe Number $\nu_d$ | 23.78 | Dispersion $n_F - n_C$       | 0.035 608 |
| Refractive Index $n_e$ | 1.855 041             | Abbe Number $\nu_e$ | 23.59 | Dispersion $n_{F'} - n_{C'}$ | 0.036 247 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.785 19 |
| $n_{1970}$         | 1.970 09  | 1.791 99 |
| $n_{1530}$         | 1.529 58  | 1.800 13 |
| $n_{1129}$         | 1.128 64  | 1.809 25 |
| $n_t$              | 1.013 98  | 1.812 94 |
| $n_s$              | 0.852 11  | 1.820 21 |
| $n_{A'}$           | 0.768 19  | 1.825 68 |
| $n_F$              | 0.706 52  | 1.830 98 |
| $n_C$              | 0.656 27  | 1.836 49 |
| $n_{C'}$           | 0.643 85  | 1.838 07 |
| $n_{He-Ne}$        | 0.632 8   | 1.839 56 |
| $n_D$              | 0.589 29  | 1.846 35 |
| $n_d$              | 0.587 56  | 1.846 66 |
| $n_e$              | 0.546 07  | 1.855 04 |
| $n_F$              | 0.486 13  | 1.872 10 |
| $n_{F'}$           | 0.479 99  | 1.874 31 |
| $n_{He-Cd}$        | 0.441 57  | 1.891 14 |
| $n_g$              | 0.435 835 | 1.894 19 |
| $n_h$              | 0.404 656 | 1.914 29 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.879 048 86E+00 |
| $A_2$                           | 3.697 197 75E-01 |
| $A_3$                           | 2.337 308 63E+00 |
| $B_1$                           | 1.441 217 70E-02 |
| $B_2$                           | 6.388 179 90E-02 |
| $B_3$                           | 1.826 681 80E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 96.0  |
| Rigidity Modulus G (GPa) | 37.9  |
| Poisson's Ratio $\sigma$ | 0.266 |
| Knoop Hardness Hk[Class] | 550 6 |
| Abrasion Aa              | 188   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.023 550 |
| $n_C - n_{A'}$      | 0.010 806 |
| $n_d - n_C$         | 0.010 172 |
| $n_e - n_C$         | 0.018 553 |
| $n_g - n_d$         | 0.047 529 |
| $n_g - n_F$         | 0.022 093 |
| $n_h - n_g$         | 0.020 105 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.025 128 |
| $n_e - n_{C'}$      | 0.016 975 |
| $n_{F'} - n_e$      | 0.019 272 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.661 4 |
| $\theta_{C,A'}$              | 0.303 5 |
| $\theta_{d,C}$               | 0.285 7 |
| $\theta_{e,C}$               | 0.521 0 |
| $\theta_{g,d}$               | 1.334 8 |
| $\theta_{g,F}$               | 0.620 5 |
| $\theta_{h,g}$               | 0.564 6 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.693 2 |
| $\theta'_{e,C'}$             | 0.468 3 |
| $\theta'_{F,e}$              | 0.531 7 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.003 2  |
| $\Delta\theta_{C,A'}$ | -0.001 2 |
| $\Delta\theta_{g,d}$  | 0.019 5  |
| $\Delta\theta_{g,F}$  | 0.017 5  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 368 |
| $\lambda_{70}$        | 404  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 398  | $\lambda_{0.05}$ | 368 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 3.49 | 3.70             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.11             |
| 380                    | 0.45             |
| 390                    | 0.71             |
| 400                    | 0.83             |
| 420                    | 0.918            |
| 440                    | 0.954            |
| 460                    | 0.971            |
| 480                    | 0.980            |
| 500                    | 0.986            |
| 550                    | 0.995            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.999            |
| 1 800                  | 0.994            |
| 2 000                  | 0.985            |
| 2 200                  | 0.961            |
| 2 400                  | 0.925            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 576  |
| Annealing Point AP (°C)                                          | 596  |
| Transformation Temperature Tg (°C)                               | 630  |
| Yield Point At (°C)                                              | 663  |
| Softening Point SP (°C)                                          | 692  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 88   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 104  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.00 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 72                                             |
| -90 ~ -80                               | 74                                             |
| -80 ~ -70                               | 75                                             |
| -70 ~ -60                               | 77                                             |
| -60 ~ -50                               | 78                                             |
| -50 ~ -40                               | 80                                             |
| -40 ~ -30                               | 81                                             |
| -30 ~ -20                               | 82                                             |
| -20 ~ -10                               | 83                                             |
| -10 ~ 0                                 | 85                                             |
| 0 ~ 10                                  | 86                                             |
| 10 ~ 20                                 | 87                                             |
| 20 ~ 30                                 | 88                                             |
| 30 ~ 40                                 | 90                                             |
| 40 ~ 50                                 | 91                                             |
| 50 ~ 60                                 | 92                                             |
| 60 ~ 70                                 | 93                                             |
| 70 ~ 80                                 | 94                                             |
| 80 ~ 90                                 | 95                                             |
| 90 ~ 100                                | 96                                             |
| 100 ~ 110                               | 97                                             |
| 110 ~ 120                               | 98                                             |
| 120 ~ 130                               | 99                                             |
| 130 ~ 140                               | 99                                             |
| 140 ~ 150                               | 100                                            |
| 150 ~ 160                               | 101                                            |
| 160 ~ 170                               | 102                                            |
| 170 ~ 180                               | 103                                            |
| 180 ~ 190                               | 103                                            |
| 190 ~ 200                               | 104                                            |
| 200 ~ 210                               | 105                                            |
| 210 ~ 220                               | 105                                            |
| 220 ~ 230                               | 106                                            |
| 230 ~ 240                               | 107                                            |
| 240 ~ 250                               | 107                                            |
| 250 ~ 260                               | 108                                            |
| 260 ~ 270                               | 108                                            |
| 270 ~ 280                               | 109                                            |
| 280 ~ 290                               | 109                                            |
| 290 ~ 300                               | 110                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.81 |
| Specific Gravity $d$                                      | 3.54 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t    | r    | C    | C'   | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | -1.4                                                            | -1.1 | -0.6 | -0.2 | -0.2 | 0.2 | 0.6 | 1.6 | 1.8 | 3.2 | 5.0  | - |
| -60 ~ -40                                    | -1.6                                                            | -1.3 | -0.7 | -0.3 | -0.3 | 0.1 | 0.6 | 1.6 | 1.8 | 3.4 | 5.3  | - |
| -40 ~ -20                                    | -1.7                                                            | -1.4 | -0.6 | -0.3 | -0.3 | 0.2 | 0.7 | 1.9 | 2.1 | 3.7 | 5.9  | - |
| -20 ~ 0                                      | -1.6                                                            | -1.3 | -0.6 | -0.3 | -0.2 | 0.3 | 0.9 | 2.1 | 2.3 | 4.1 | 6.5  | - |
| 0 ~ 20                                       | -1.6                                                            | -1.2 | -0.4 | -0.1 | 0.0  | 0.5 | 1.2 | 2.5 | 2.7 | 4.6 | 7.1  | - |
| 20 ~ 40                                      | -1.5                                                            | -1.1 | -0.2 | 0.1  | 0.2  | 0.8 | 1.4 | 2.8 | 3.1 | 5.2 | 7.8  | - |
| 40 ~ 60                                      | -1.4                                                            | -1.0 | 0.0  | 0.3  | 0.4  | 1.0 | 1.7 | 3.3 | 3.5 | 5.7 | 8.5  | - |
| 60 ~ 80                                      | -1.3                                                            | -0.9 | 0.2  | 0.5  | 0.6  | 1.4 | 2.1 | 3.7 | 3.9 | 6.2 | 9.2  | - |
| 80 ~ 100                                     | -1.1                                                            | -0.6 | 0.4  | 0.8  | 0.9  | 1.6 | 2.3 | 4.1 | 4.4 | 6.8 | 9.9  | - |
| 100 ~ 120                                    | -1.0                                                            | -0.5 | 0.7  | 1.1  | 1.2  | 1.9 | 2.7 | 4.5 | 4.7 | 7.3 | 10.7 | - |
| 120 ~ 140                                    | -0.8                                                            | -0.3 | 0.9  | 1.3  | 1.5  | 2.2 | 3.0 | 4.9 | 5.2 | 7.9 | 11.4 | - |
| 140 ~ 160                                    | -0.7                                                            | -0.2 | 1.1  | 1.6  | 1.7  | 2.5 | 3.3 | 5.3 | 5.6 | 8.6 | 12.1 | - |
| 160 ~ 180                                    | -0.6                                                            | 0.0  | 1.3  | 1.9  | 2.0  | 2.8 | 3.7 | 5.8 | 6.1 | 9.1 | 12.8 | - |

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## S-TIH53WN

Code(d) 847239

Code(e) 855237

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.846 66<br>1.846 660 | Abbe Number $\nu_d$ | 23.86 | Dispersion $n_F - n_C$       | 0.035 480 |
| Refractive Index $n_e$ | 1.855 009             | Abbe Number $\nu_e$ | 23.67 | Dispersion $n_{F'} - n_{C'}$ | 0.036 118 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.785 33 |
| $n_{1970}$         | 1.970 09  | 1.792 14 |
| $n_{1530}$         | 1.529 58  | 1.800 28 |
| $n_{1129}$         | 1.128 64  | 1.809 39 |
| $n_t$              | 1.013 98  | 1.813 07 |
| $n_s$              | 0.852 11  | 1.820 31 |
| $n_{A'}$           | 0.768 19  | 1.825 76 |
| $n_F$              | 0.706 52  | 1.831 04 |
| $n_C$              | 0.656 27  | 1.836 53 |
| $n_{C'}$           | 0.643 85  | 1.838 10 |
| $n_{He-Ne}$        | 0.632 8   | 1.839 58 |
| $n_D$              | 0.589 29  | 1.846 35 |
| $n_d$              | 0.587 56  | 1.846 66 |
| $n_e$              | 0.546 07  | 1.855 01 |
| $n_F$              | 0.486 13  | 1.872 01 |
| $n_{F'}$           | 0.479 99  | 1.874 22 |
| $n_{He-Cd}$        | 0.441 57  | 1.890 99 |
| $n_g$              | 0.435 835 | 1.894 03 |
| $n_h$              | 0.404 656 | 1.914 09 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.873 080 69E+00 |
| $A_2$                           | 3.764 602 62E-01 |
| $A_3$                           | 2.374 417 73E+00 |
| $B_1$                           | 1.413 646 36E-02 |
| $B_2$                           | 6.363 748 77E-02 |
| $B_3$                           | 1.848 987 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 96.0  |
| Rigidity Modulus G (GPa) | 37.9  |
| Poisson's Ratio $\sigma$ | 0.266 |
| Knoop Hardness Hk[Class] | 550 6 |
| Abrasion Aa              | 188   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.023 459 |
| $n_C - n_{A'}$      | 0.010 763 |
| $n_d - n_C$         | 0.010 133 |
| $n_e - n_C$         | 0.018 482 |
| $n_g - n_d$         | 0.047 374 |
| $n_g - n_F$         | 0.022 027 |
| $n_h - n_g$         | 0.020 053 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.025 031 |
| $n_e - n_{C'}$      | 0.016 910 |
| $n_{F'} - n_e$      | 0.019 208 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.661 2 |
| $\theta_{C,A'}$              | 0.303 4 |
| $\theta_{d,C}$               | 0.285 6 |
| $\theta_{e,C}$               | 0.520 9 |
| $\theta_{g,d}$               | 1.335 2 |
| $\theta_{g,F}$               | 0.620 8 |
| $\theta_{h,g}$               | 0.565 2 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.693 0 |
| $\theta'_{e,C'}$             | 0.468 2 |
| $\theta'_{F,e}$              | 0.531 8 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.002 6  |
| $\Delta\theta_{C,A'}$ | -0.001 4 |
| $\Delta\theta_{g,d}$  | 0.020 1  |
| $\Delta\theta_{g,F}$  | 0.017 9  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        |      | $\lambda_5$      | 368 |
| $\lambda_{70}$        | 404  |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 398  | $\lambda_{0.05}$ | 368 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 3.49 | 3.70             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.11             |
| 380                    | 0.45             |
| 390                    | 0.71             |
| 400                    | 0.83             |
| 420                    | 0.918            |
| 440                    | 0.954            |
| 460                    | 0.971            |
| 480                    | 0.980            |
| 500                    | 0.986            |
| 550                    | 0.995            |
| 600                    | 0.999            |
| 650                    | 0.999            |
| 700                    | 0.999            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.999            |
| 1 600                  | 0.999            |
| 1 800                  | 0.994            |
| 2 000                  | 0.985            |
| 2 200                  | 0.961            |
| 2 400                  | 0.925            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 576  |
| Annealing Point AP (°C)                                          | 596  |
| Transformation Temperature Tg (°C)                               | 630  |
| Yield Point At (°C)                                              | 663  |
| Softening Point SP (°C)                                          | 692  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 88   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 104  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.00 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 72                                             |
| -90 ~ -80                               | 74                                             |
| -80 ~ -70                               | 75                                             |
| -70 ~ -60                               | 77                                             |
| -60 ~ -50                               | 78                                             |
| -50 ~ -40                               | 80                                             |
| -40 ~ -30                               | 81                                             |
| -30 ~ -20                               | 82                                             |
| -20 ~ -10                               | 83                                             |
| -10 ~ 0                                 | 85                                             |
| 0 ~ 10                                  | 86                                             |
| 10 ~ 20                                 | 87                                             |
| 20 ~ 30                                 | 88                                             |
| 30 ~ 40                                 | 90                                             |
| 40 ~ 50                                 | 91                                             |
| 50 ~ 60                                 | 92                                             |
| 60 ~ 70                                 | 93                                             |
| 70 ~ 80                                 | 94                                             |
| 80 ~ 90                                 | 95                                             |
| 90 ~ 100                                | 96                                             |
| 100 ~ 110                               | 97                                             |
| 110 ~ 120                               | 98                                             |
| 120 ~ 130                               | 99                                             |
| 130 ~ 140                               | 99                                             |
| 140 ~ 150                               | 100                                            |
| 150 ~ 160                               | 101                                            |
| 160 ~ 170                               | 102                                            |
| 170 ~ 180                               | 103                                            |
| 180 ~ 190                               | 103                                            |
| 190 ~ 200                               | 104                                            |
| 200 ~ 210                               | 105                                            |
| 210 ~ 220                               | 105                                            |
| 220 ~ 230                               | 106                                            |
| 230 ~ 240                               | 107                                            |
| 240 ~ 250                               | 107                                            |
| 250 ~ 260                               | 108                                            |
| 260 ~ 270                               | 108                                            |
| 270 ~ 280                               | 109                                            |
| 280 ~ 290                               | 109                                            |
| 290 ~ 300                               | 110                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.81 |
| Specific Gravity $d$                                      | 3.54 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |      |      |      |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|------|------|------|------|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |      |      |      |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t    | r    | C    | C'   | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | -1.4                                                            | -1.1 | -0.6 | -0.2 | -0.2 | 0.2 | 0.6 | 1.6 | 1.8 | 3.2 | 5.0  | - |
| -60 ~ -40                                    | -1.6                                                            | -1.3 | -0.7 | -0.3 | -0.3 | 0.1 | 0.6 | 1.6 | 1.8 | 3.4 | 5.3  | - |
| -40 ~ -20                                    | -1.7                                                            | -1.4 | -0.6 | -0.3 | -0.3 | 0.2 | 0.7 | 1.9 | 2.1 | 3.7 | 5.9  | - |
| -20 ~ 0                                      | -1.6                                                            | -1.3 | -0.6 | -0.3 | -0.2 | 0.3 | 0.9 | 2.1 | 2.3 | 4.1 | 6.5  | - |
| 0 ~ 20                                       | -1.6                                                            | -1.2 | -0.4 | -0.1 | 0.0  | 0.5 | 1.2 | 2.5 | 2.7 | 4.6 | 7.1  | - |
| 20 ~ 40                                      | -1.5                                                            | -1.1 | -0.2 | 0.1  | 0.2  | 0.8 | 1.4 | 2.8 | 3.1 | 5.2 | 7.8  | - |
| 40 ~ 60                                      | -1.4                                                            | -1.0 | 0.0  | 0.3  | 0.4  | 1.0 | 1.7 | 3.3 | 3.5 | 5.7 | 8.5  | - |
| 60 ~ 80                                      | -1.3                                                            | -0.9 | 0.2  | 0.5  | 0.6  | 1.4 | 2.1 | 3.7 | 3.9 | 6.2 | 9.2  | - |
| 80 ~ 100                                     | -1.1                                                            | -0.6 | 0.4  | 0.8  | 0.9  | 1.6 | 2.3 | 4.1 | 4.4 | 6.8 | 9.9  | - |
| 100 ~ 120                                    | -1.0                                                            | -0.5 | 0.7  | 1.1  | 1.2  | 1.9 | 2.7 | 4.5 | 4.7 | 7.3 | 10.7 | - |
| 120 ~ 140                                    | -0.8                                                            | -0.3 | 0.9  | 1.3  | 1.5  | 2.2 | 3.0 | 4.9 | 5.2 | 7.9 | 11.4 | - |
| 140 ~ 160                                    | -0.7                                                            | -0.2 | 1.1  | 1.6  | 1.7  | 2.5 | 3.3 | 5.3 | 5.6 | 8.6 | 12.1 | - |
| 160 ~ 180                                    | -0.6                                                            | 0.0  | 1.3  | 1.9  | 2.0  | 2.8 | 3.7 | 5.8 | 6.1 | 9.1 | 12.8 | - |

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|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.963 00<br>1.963 000 | Abbe Number $\nu_d$ | 24.11 | Dispersion $n_F - n_C$       | 0.039 935 |
| Refractive Index $n_e$ | 1.972 398             | Abbe Number $\nu_e$ | 23.92 | Dispersion $n_{F'} - n_{C'}$ | 0.040 656 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.893 94 |
| $n_{1970}$         | 1.970 09  | 1.901 63 |
| $n_{1530}$         | 1.529 58  | 1.910 82 |
| $n_{1129}$         | 1.128 64  | 1.921 06 |
| $n_t$              | 1.013 98  | 1.925 20 |
| $n_s$              | 0.852 11  | 1.933 35 |
| $n_{A'}$           | 0.768 19  | 1.939 49 |
| $n_F$              | 0.706 52  | 1.945 42 |
| $n_C$              | 0.656 27  | 1.951 60 |
| $n_{C'}$           | 0.643 85  | 1.953 37 |
| $n_{He-Ne}$        | 0.632 8   | 1.955 04 |
| $n_D$              | 0.589 29  | 1.962 66 |
| $n_d$              | 0.587 56  | 1.963 00 |
| $n_e$              | 0.546 07  | 1.972 40 |
| $n_F$              | 0.486 13  | 1.991 53 |
| $n_{F'}$           | 0.479 99  | 1.994 02 |
| $n_{He-Cd}$        | 0.441 57  | 2.012 91 |
| $n_g$              | 0.435 835 | 2.016 34 |
| $n_h$              | 0.404 656 | 2.038 93 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 2.211 032 56E+00 |
| $A_2$                           | 4.503 469 86E-01 |
| $A_3$                           | 2.477 466 63E+00 |
| $B_1$                           | 1.423 302 68E-02 |
| $B_2$                           | 6.385 733 92E-02 |
| $B_3$                           | 1.619 376 00E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 3.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 117.0 |
| Rigidity Modulus G (GPa) | 45.3  |
| Poisson's Ratio $\sigma$ | 0.292 |
| Knoop Hardness Hk[Class] | 640 6 |
| Abrasion Aa              | 102   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.026 394 |
| $n_C - n_{A'}$      | 0.012 111 |
| $n_d - n_C$         | 0.011 402 |
| $n_e - n_C$         | 0.020 800 |
| $n_g - n_d$         | 0.053 340 |
| $n_g - n_F$         | 0.024 807 |
| $n_h - n_g$         | 0.022 594 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.028 162 |
| $n_e - n_{C'}$      | 0.019 032 |
| $n_{F'} - n_e$      | 0.021 624 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.660 9 |
| $\theta_{C,A'}$              | 0.303 3 |
| $\theta_{d,C}$               | 0.285 5 |
| $\theta_{e,C}$               | 0.520 8 |
| $\theta_{g,d}$               | 1.335 7 |
| $\theta_{g,F}$               | 0.621 2 |
| $\theta_{h,g}$               | 0.565 8 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.692 7 |
| $\theta'_{e,C'}$             | 0.468 1 |
| $\theta'_{F,e}$              | 0.531 9 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.001 1  |
| $\Delta\theta_{C,A'}$ | -0.001 8 |
| $\Delta\theta_{g,d}$  | 0.021 1  |
| $\Delta\theta_{g,F}$  | 0.018 7  |
| $\Delta\theta_{i,g}$  |          |

| Coloring              |       |                  |     |
|-----------------------|-------|------------------|-----|
| $\lambda_{80}$        |       | $\lambda_5$      | 375 |
| $\lambda_{70}$        | 450   |                  |     |
| Internal transmission |       |                  |     |
| $\lambda_{0.80}$      | 433   | $\lambda_{0.05}$ | 373 |
| CCI                   |       |                  |     |
| B                     | G     | R                |     |
| 0.00                  | 10.27 | 10.95            |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.02             |
| 380                    | 0.13             |
| 390                    | 0.33             |
| 400                    | 0.51             |
| 420                    | 0.73             |
| 440                    | 0.84             |
| 460                    | 0.90             |
| 480                    | 0.929            |
| 500                    | 0.950            |
| 550                    | 0.979            |
| 600                    | 0.988            |
| 650                    | 0.991            |
| 700                    | 0.994            |
| 800                    | 0.997            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.997            |
| 1 600                  | 0.995            |
| 1 800                  | 0.989            |
| 2 000                  | 0.977            |
| 2 200                  | 0.947            |
| 2 400                  | 0.85             |

| Thermal Properties                                               |       |
|------------------------------------------------------------------|-------|
| Strain Point StP (°C)                                            | 634   |
| Annealing Point AP (°C)                                          | 661   |
| Transformation Temperature Tg (°C)                               | 677   |
| Yield Point At (°C)                                              | 713   |
| Softening Point SP (°C)                                          | 732   |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 78    |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 93    |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 0.970 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 63                                             |
| -90 ~ -80                               | 64                                             |
| -80 ~ -70                               | 66                                             |
| -70 ~ -60                               | 67                                             |
| -60 ~ -50                               | 68                                             |
| -50 ~ -40                               | 70                                             |
| -40 ~ -30                               | 71                                             |
| -30 ~ -20                               | 72                                             |
| -20 ~ -10                               | 74                                             |
| -10 ~ 0                                 | 75                                             |
| 0 ~ 10                                  | 76                                             |
| 10 ~ 20                                 | 77                                             |
| 20 ~ 30                                 | 78                                             |
| 30 ~ 40                                 | 79                                             |
| 40 ~ 50                                 | 81                                             |
| 50 ~ 60                                 | 82                                             |
| 60 ~ 70                                 | 83                                             |
| 70 ~ 80                                 | 84                                             |
| 80 ~ 90                                 | 85                                             |
| 90 ~ 100                                | 86                                             |
| 100 ~ 110                               | 86                                             |
| 110 ~ 120                               | 87                                             |
| 120 ~ 130                               | 88                                             |
| 130 ~ 140                               | 89                                             |
| 140 ~ 150                               | 90                                             |
| 150 ~ 160                               | 91                                             |
| 160 ~ 170                               | 91                                             |
| 170 ~ 180                               | 92                                             |
| 180 ~ 190                               | 93                                             |
| 190 ~ 200                               | 93                                             |
| 200 ~ 210                               | 94                                             |
| 210 ~ 220                               | 95                                             |
| 220 ~ 230                               | 95                                             |
| 230 ~ 240                               | 96                                             |
| 240 ~ 250                               | 96                                             |
| 250 ~ 260                               | 97                                             |
| 260 ~ 270                               | 97                                             |
| 270 ~ 280                               | 98                                             |
| 280 ~ 290                               | 98                                             |
| 290 ~ 300                               | 98                                             |

| Other Properties                            |      |
|---------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm·105Pa) | 1.73 |
| Specific Gravity $d$                        | 4.20 |
| Remarks                                     |      |

| Temperature Coefficients of Refractive Index |                                                                 |      |     |     |     |     |     |     |     |     |      |   |
|----------------------------------------------|-----------------------------------------------------------------|------|-----|-----|-----|-----|-----|-----|-----|-----|------|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |      |     |     |     |     |     |     |     |     |      |   |
|                                              | 1550                                                            | t    | r   | C   | C'  | d   | e   | F   | F'  | g   | h    | i |
| -80 ~ -60                                    | -1.0                                                            | -0.7 | 0.1 | 0.3 | 0.4 | 0.9 | 1.5 | 2.7 | 2.9 | 4.7 | 7.1  | - |
| -60 ~ -40                                    | -1.1                                                            | -0.7 | 0.1 | 0.4 | 0.4 | 1.0 | 1.6 | 2.8 | 3.0 | 5.0 | 7.4  | - |
| -40 ~ -20                                    | -0.9                                                            | -0.6 | 0.2 | 0.5 | 0.6 | 1.2 | 1.8 | 3.1 | 3.3 | 5.4 | 7.9  | - |
| -20 ~ 0                                      | -0.8                                                            | -0.4 | 0.4 | 0.8 | 0.9 | 1.5 | 2.1 | 3.5 | 3.7 | 5.8 | 8.5  | - |
| 0 ~ 20                                       | -0.6                                                            | -0.2 | 0.7 | 1.0 | 1.1 | 1.8 | 2.4 | 3.9 | 4.1 | 6.3 | 9.1  | - |
| 20 ~ 40                                      | -0.5                                                            | 0.0  | 1.0 | 1.3 | 1.4 | 2.0 | 2.7 | 4.3 | 4.5 | 6.8 | 9.6  | - |
| 40 ~ 60                                      | -0.2                                                            | 0.2  | 1.2 | 1.6 | 1.7 | 2.3 | 3.0 | 4.6 | 4.8 | 7.3 | 10.3 | - |
| 60 ~ 80                                      | -0.1                                                            | 0.4  | 1.4 | 1.8 | 1.9 | 2.6 | 3.4 | 5.0 | 5.3 | 7.7 | 10.8 | - |
| 80 ~ 100                                     | 0.0                                                             | 0.6  | 1.7 | 2.1 | 2.2 | 2.9 | 3.6 | 5.3 | 5.6 | 8.2 | 11.4 | - |
| 100 ~ 120                                    | 0.2                                                             | 0.6  | 1.9 | 2.3 | 2.4 | 3.1 | 3.9 | 5.6 | 5.9 | 8.5 | 11.9 | - |
| 120 ~ 140                                    | 0.2                                                             | 0.8  | 2.0 | 2.4 | 2.6 | 3.3 | 4.1 | 5.9 | 6.2 | 8.9 | 12.4 | - |
| 140 ~ 160                                    | 0.3                                                             | 0.8  | 2.1 | 2.6 | 2.7 | 3.4 | 4.3 | 6.2 | 6.5 | 9.3 | 12.8 | - |
| 160 ~ 180                                    | 0.4                                                             | 0.9  | 2.2 | 2.6 | 2.8 | 3.6 | 4.4 | 6.4 | 6.7 | 9.5 | 13.3 | - |

## S-TIL 1

Code(d) 548458

Code(e) 551455

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.548 14<br>1.548 141 | Abbe Number $\nu_d$ | 45.79 | Dispersion $n_F - n_C$       | 0.011 972 |
| Refractive Index $n_e$ | 1.550 984             | Abbe Number $\nu_e$ | 45.49 | Dispersion $n_{F'} - n_{C'}$ | 0.012 112 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.517 97 |
| $n_{1970}$         | 1.970 09  | 1.523 07 |
| $n_{1530}$         | 1.529 58  | 1.528 61 |
| $n_{1129}$         | 1.128 64  | 1.533 65 |
| $n_t$              | 1.013 98  | 1.535 37 |
| $n_s$              | 0.852 11  | 1.538 44 |
| $n_{A'}$           | 0.768 19  | 1.540 58 |
| $n_F$              | 0.706 52  | 1.542 57 |
| $n_C$              | 0.656 27  | 1.544 57 |
| $n_{C'}$           | 0.643 85  | 1.545 14 |
| $n_{He-Ne}$        | 0.632 8   | 1.545 66 |
| $n_D$              | 0.589 29  | 1.548 04 |
| $n_d$              | 0.587 56  | 1.548 14 |
| $n_e$              | 0.546 07  | 1.550 98 |
| $n_F$              | 0.486 13  | 1.556 54 |
| $n_{F'}$           | 0.479 99  | 1.557 25 |
| $n_{He-Cd}$        | 0.441 57  | 1.562 44 |
| $n_g$              | 0.435 835 | 1.563 35 |
| $n_h$              | 0.404 656 | 1.569 18 |
| $n_i$              | 0.365 015 | 1.579 59 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.250 889 44E+00 |
| $A_2$                           | 9.979 733 27E-02 |
| $A_3$                           | 1.205 835 04E+00 |
| $B_1$                           | 8.839 212 79E-03 |
| $B_2$                           | 4.826 850 52E-02 |
| $B_3$                           | 1.374 149 53E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 3   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 70.5  |
| Rigidity Modulus G (GPa) | 28.8  |
| Poisson's Ratio $\sigma$ | 0.222 |
| Knoop Hardness Hk[Class] | 490 5 |
| Abrasion Aa              | 132   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.009 202 |
| $n_C - n_{A'}$      | 0.003 988 |
| $n_d - n_C$         | 0.003 569 |
| $n_e - n_C$         | 0.006 412 |
| $n_g - n_d$         | 0.015 210 |
| $n_g - n_F$         | 0.006 807 |
| $n_h - n_g$         | 0.005 833 |
| $n_i - n_g$         | 0.016 236 |
| $n_{C'} - n_t$      | 0.009 765 |
| $n_e - n_{C'}$      | 0.005 849 |
| $n_{F'} - n_e$      | 0.006 263 |
| $n_i - n_{F'}$      | 0.022 340 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.768 6 |
| $\theta_{C,A'}$              | 0.333 1 |
| $\theta_{d,C}$               | 0.298 1 |
| $\theta_{e,C}$               | 0.535 6 |
| $\theta_{g,d}$               | 1.270 5 |
| $\theta_{g,F}$               | 0.568 6 |
| $\theta_{h,g}$               | 0.487 2 |
| $\theta_{i,g}$               | 1.356 2 |
| $\theta'_{C,t}$              | 0.806 2 |
| $\theta'_{e,C'}$             | 0.482 9 |
| $\theta'_{F',e}$             | 0.517 1 |
| $\theta'_{i,F'}$             | 1.844 5 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.007 1 |
| $\Delta\theta_{C,A'}$ | 0.001 7 |
| $\Delta\theta_{g,d}$  | 0.000 9 |
| $\Delta\theta_{g,F}$  | 0.001 2 |
| $\Delta\theta_{i,g}$  | 0.014 6 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 370  | $\lambda_5$      | 340 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 366  | $\lambda_{0.05}$ | 341 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.32 | 0.33             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.01             |
| 350                    | 0.29             |
| 360                    | 0.69             |
| 370                    | 0.87             |
| 380                    | 0.944            |
| 390                    | 0.972            |
| 400                    | 0.984            |
| 420                    | 0.992            |
| 440                    | 0.994            |
| 460                    | 0.995            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.996            |
| 1 600                  | 0.993            |
| 1 800                  | 0.977            |
| 2 000                  | 0.948            |
| 2 200                  | 0.89             |
| 2 400                  | 0.85             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 452  |
| Annealing Point AP (°C)                                          | 487  |
| Transformation Temperature Tg (°C)                               | 500  |
| Yield Point At (°C)                                              | 566  |
| Softening Point SP (°C)                                          | 654  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 84   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 103  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.04 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 67                                             |
| -90 ~ -80                               | 69                                             |
| -80 ~ -70                               | 71                                             |
| -70 ~ -60                               | 73                                             |
| -60 ~ -50                               | 74                                             |
| -50 ~ -40                               | 76                                             |
| -40 ~ -30                               | 78                                             |
| -30 ~ -20                               | 79                                             |
| -20 ~ -10                               | 81                                             |
| -10 ~ 0                                 | 82                                             |
| 0 ~ 10                                  | 84                                             |
| 10 ~ 20                                 | 85                                             |
| 20 ~ 30                                 | 86                                             |
| 30 ~ 40                                 | 88                                             |
| 40 ~ 50                                 | 89                                             |
| 50 ~ 60                                 | 90                                             |
| 60 ~ 70                                 | 91                                             |
| 70 ~ 80                                 | 92                                             |
| 80 ~ 90                                 | 94                                             |
| 90 ~ 100                                | 95                                             |
| 100 ~ 110                               | 96                                             |
| 110 ~ 120                               | 97                                             |
| 120 ~ 130                               | 98                                             |
| 130 ~ 140                               | 98                                             |
| 140 ~ 150                               | 99                                             |
| 150 ~ 160                               | 100                                            |
| 160 ~ 170                               | 101                                            |
| 170 ~ 180                               | 102                                            |
| 180 ~ 190                               | 102                                            |
| 190 ~ 200                               | 103                                            |
| 200 ~ 210                               | 103                                            |
| 210 ~ 220                               | 104                                            |
| 220 ~ 230                               | 104                                            |
| 230 ~ 240                               | 105                                            |
| 240 ~ 250                               | 105                                            |
| 250 ~ 260                               | 106                                            |
| 260 ~ 270                               | 106                                            |
| 270 ~ 280                               | 106                                            |
| 280 ~ 290                               | 107                                            |
| 290 ~ 300                               | 107                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.68 |
| Specific Gravity $d$                                     | 2.54 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.1                                                             | 1.3 | 1.5 | 1.6 | 1.6 | 1.8 | 2.0 | 2.4 | 2.4 | 2.8 | 3.3 | 4.4 |
| -60 ~ -40                                    | 0.9                                                             | 1.0 | 1.4 | 1.5 | 1.5 | 1.6 | 1.8 | 2.2 | 2.2 | 2.7 | 3.2 | 4.2 |
| -40 ~ -20                                    | 0.7                                                             | 1.0 | 1.3 | 1.4 | 1.4 | 1.6 | 1.7 | 2.1 | 2.2 | 2.7 | 3.2 | 4.3 |
| -20 ~ 0                                      | 0.7                                                             | 1.0 | 1.3 | 1.4 | 1.4 | 1.6 | 1.8 | 2.1 | 2.2 | 2.7 | 3.3 | 4.4 |
| 0 ~ 20                                       | 0.7                                                             | 0.9 | 1.2 | 1.3 | 1.4 | 1.7 | 1.8 | 2.3 | 2.3 | 2.8 | 3.4 | 4.6 |
| 20 ~ 40                                      | 0.8                                                             | 0.9 | 1.3 | 1.4 | 1.4 | 1.6 | 1.9 | 2.3 | 2.4 | 2.9 | 3.5 | 4.7 |
| 40 ~ 60                                      | 0.9                                                             | 1.0 | 1.4 | 1.5 | 1.6 | 1.8 | 2.0 | 2.4 | 2.5 | 3.0 | 3.6 | 4.9 |
| 60 ~ 80                                      | 0.9                                                             | 1.0 | 1.4 | 1.6 | 1.6 | 1.9 | 2.1 | 2.6 | 2.6 | 3.2 | 3.8 | 5.2 |
| 80 ~ 100                                     | 0.9                                                             | 1.1 | 1.5 | 1.6 | 1.7 | 1.9 | 2.1 | 2.7 | 2.7 | 3.4 | 4.0 | 5.4 |
| 100 ~ 120                                    | 1.0                                                             | 1.2 | 1.5 | 1.7 | 1.7 | 2.0 | 2.3 | 2.8 | 2.8 | 3.5 | 4.2 | 5.6 |
| 120 ~ 140                                    | 1.0                                                             | 1.3 | 1.7 | 1.8 | 1.9 | 2.1 | 2.4 | 2.9 | 2.9 | 3.6 | 4.3 | 5.8 |
| 140 ~ 160                                    | 1.1                                                             | 1.3 | 1.7 | 1.9 | 1.9 | 2.1 | 2.4 | 2.9 | 3.0 | 3.7 | 4.4 | 5.9 |
| 160 ~ 180                                    | 1.1                                                             | 1.3 | 1.7 | 1.9 | 1.9 | 2.2 | 2.4 | 3.0 | 3.0 | 3.7 | 4.5 | 6.2 |

OHARA 25-04

## S-TIL 2

Code(d) 541472

Code(e) 543469

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.540 72<br>1.540 720 | Abbe Number $\nu_d$ | 47.23 | Dispersion $n_F - n_C$       | 0.011 449 |
| Refractive Index $n_e$ | 1.543 440             | Abbe Number $\nu_e$ | 46.94 | Dispersion $n_{F'} - n_{C'}$ | 0.011 577 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.511 18 |
| $n_{1970}$         | 1.970 09  | 1.516 26 |
| $n_{1530}$         | 1.529 58  | 1.521 76 |
| $n_{1129}$         | 1.128 64  | 1.526 72 |
| $n_t$              | 1.013 98  | 1.528 41 |
| $n_s$              | 0.852 11  | 1.531 39 |
| $n_{A'}$           | 0.768 19  | 1.533 46 |
| $n_F$              | 0.706 52  | 1.535 37 |
| $n_C$              | 0.656 27  | 1.537 30 |
| $n_{C'}$           | 0.643 85  | 1.537 84 |
| $n_{He-Ne}$        | 0.632 8   | 1.538 35 |
| $n_D$              | 0.589 29  | 1.540 62 |
| $n_d$              | 0.587 56  | 1.540 72 |
| $n_e$              | 0.546 07  | 1.543 44 |
| $n_F$              | 0.486 13  | 1.548 75 |
| $n_{F'}$           | 0.479 99  | 1.549 42 |
| $n_{He-Cd}$        | 0.441 57  | 1.554 35 |
| $n_g$              | 0.435 835 | 1.555 22 |
| $n_h$              | 0.404 656 | 1.560 74 |
| $n_i$              | 0.365 015 | 1.570 52 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.234 014 99E+00 |
| $A_2$                           | 9.597 968 33E-02 |
| $A_3$                           | 1.205 039 91E+00 |
| $B_1$                           | 8.695 078 01E-03 |
| $B_2$                           | 4.656 114 29E-02 |
| $B_3$                           | 1.379 533 01E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 2   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |         |
|--------------------------|---------|
| Young's Modulus E (GPa)  | 69.9    |
| Rigidity Modulus G (GPa) | 28.6    |
| Poisson's Ratio $\sigma$ | 0.220   |
| Knoop Hardness Hk[Class] | 500   5 |
| Abrasion Aa              | 122     |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 891 |
| $n_C - n_{A'}$      | 0.003 839 |
| $n_d - n_C$         | 0.003 423 |
| $n_e - n_C$         | 0.006 143 |
| $n_g - n_d$         | 0.014 496 |
| $n_g - n_F$         | 0.006 470 |
| $n_h - n_g$         | 0.005 521 |
| $n_i - n_g$         | 0.015 308 |
| $n_{C'} - n_t$      | 0.009 432 |
| $n_e - n_{C'}$      | 0.005 602 |
| $n_{F'} - n_e$      | 0.005 975 |
| $n_i - n_{F'}$      | 0.021 109 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.776 6 |
| $\theta_{C,A'}$              | 0.335 3 |
| $\theta_{d,C}$               | 0.299 0 |
| $\theta_{e,C}$               | 0.536 6 |
| $\theta_{g,d}$               | 1.266 1 |
| $\theta_{g,F}$               | 0.565 1 |
| $\theta_{h,g}$               | 0.482 2 |
| $\theta_{i,g}$               | 1.337 1 |
| $\theta'_{C,t}$              | 0.814 7 |
| $\theta'_{e,C'}$             | 0.483 9 |
| $\theta'_{F,e}$              | 0.516 1 |
| $\theta'_{i,F'}$             | 1.823 4 |

| Anomalous dispersion  |          |
|-----------------------|----------|
| $\Delta\theta_{C,t}$  | 0.008 3  |
| $\Delta\theta_{C,A'}$ | 0.002 2  |
| $\Delta\theta_{g,d}$  | -0.000 5 |
| $\Delta\theta_{g,F}$  | 0.000 0  |
| $\Delta\theta_{i,g}$  | 0.007 6  |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 370  | $\lambda_5$      | 340 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 368  | $\lambda_{0.05}$ | 340 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.40 | 0.38             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.04             |
| 350                    | 0.32             |
| 360                    | 0.66             |
| 370                    | 0.84             |
| 380                    | 0.925            |
| 390                    | 0.962            |
| 400                    | 0.979            |
| 420                    | 0.990            |
| 440                    | 0.994            |
| 460                    | 0.995            |
| 480                    | 0.996            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.997            |
| 1 200                  | 0.997            |
| 1 400                  | 0.997            |
| 1 600                  | 0.995            |
| 1 800                  | 0.987            |
| 2 000                  | 0.970            |
| 2 200                  | 0.942            |
| 2 400                  | 0.917            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 448  |
| Annealing Point AP (°C)                                          | 484  |
| Transformation Temperature Tg (°C)                               | 498  |
| Yield Point At (°C)                                              | 571  |
| Softening Point SP (°C)                                          | 658  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 82   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 98   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.05 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 66                                             |
| -90 ~ -80                               | 68                                             |
| -80 ~ -70                               | 69                                             |
| -70 ~ -60                               | 71                                             |
| -60 ~ -50                               | 72                                             |
| -50 ~ -40                               | 74                                             |
| -40 ~ -30                               | 75                                             |
| -30 ~ -20                               | 77                                             |
| -20 ~ -10                               | 78                                             |
| -10 ~ 0                                 | 80                                             |
| 0 ~ 10                                  | 81                                             |
| 10 ~ 20                                 | 82                                             |
| 20 ~ 30                                 | 83                                             |
| 30 ~ 40                                 | 85                                             |
| 40 ~ 50                                 | 86                                             |
| 50 ~ 60                                 | 87                                             |
| 60 ~ 70                                 | 88                                             |
| 70 ~ 80                                 | 89                                             |
| 80 ~ 90                                 | 90                                             |
| 90 ~ 100                                | 91                                             |
| 100 ~ 110                               | 92                                             |
| 110 ~ 120                               | 93                                             |
| 120 ~ 130                               | 94                                             |
| 130 ~ 140                               | 94                                             |
| 140 ~ 150                               | 95                                             |
| 150 ~ 160                               | 96                                             |
| 160 ~ 170                               | 97                                             |
| 170 ~ 180                               | 97                                             |
| 180 ~ 190                               | 98                                             |
| 190 ~ 200                               | 98                                             |
| 200 ~ 210                               | 99                                             |
| 210 ~ 220                               | 100                                            |
| 220 ~ 230                               | 100                                            |
| 230 ~ 240                               | 101                                            |
| 240 ~ 250                               | 101                                            |
| 250 ~ 260                               | 101                                            |
| 260 ~ 270                               | 102                                            |
| 270 ~ 280                               | 102                                            |
| 280 ~ 290                               | 102                                            |
| 290 ~ 300                               | 102                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.74 |
| Specific Gravity $d$                                     | 2.52 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.1                                                             | 1.2 | 1.5 | 1.6 | 1.7 | 1.8 | 2.0 | 2.3 | 2.3 | 2.8 | 3.2 | 4.2 |
| -60 ~ -40                                    | 0.9                                                             | 1.1 | 1.4 | 1.5 | 1.5 | 1.7 | 1.8 | 2.2 | 2.2 | 2.6 | 3.2 | 4.2 |
| -40 ~ -20                                    | 0.9                                                             | 1.0 | 1.4 | 1.4 | 1.5 | 1.6 | 1.8 | 2.1 | 2.2 | 2.6 | 3.2 | 4.2 |
| -20 ~ 0                                      | 0.8                                                             | 1.0 | 1.4 | 1.5 | 1.5 | 1.7 | 1.8 | 2.2 | 2.2 | 2.7 | 3.2 | 4.3 |
| 0 ~ 20                                       | 0.9                                                             | 1.1 | 1.3 | 1.5 | 1.5 | 1.7 | 1.8 | 2.3 | 2.4 | 2.8 | 3.3 | 4.4 |
| 20 ~ 40                                      | 0.9                                                             | 1.1 | 1.4 | 1.5 | 1.5 | 1.7 | 2.0 | 2.4 | 2.4 | 2.9 | 3.5 | 4.6 |
| 40 ~ 60                                      | 1.0                                                             | 1.2 | 1.5 | 1.7 | 1.7 | 1.9 | 2.1 | 2.5 | 2.5 | 3.0 | 3.6 | 4.8 |
| 60 ~ 80                                      | 1.0                                                             | 1.2 | 1.5 | 1.7 | 1.7 | 1.9 | 2.2 | 2.6 | 2.7 | 3.2 | 3.8 | 5.0 |
| 80 ~ 100                                     | 1.1                                                             | 1.3 | 1.6 | 1.8 | 1.8 | 2.0 | 2.2 | 2.7 | 2.8 | 3.3 | 3.9 | 5.2 |
| 100 ~ 120                                    | 1.2                                                             | 1.3 | 1.7 | 1.8 | 1.9 | 2.1 | 2.3 | 2.8 | 2.8 | 3.4 | 4.1 | 5.3 |
| 120 ~ 140                                    | 1.2                                                             | 1.3 | 1.8 | 2.0 | 2.0 | 2.2 | 2.4 | 2.9 | 2.9 | 3.5 | 4.2 | 5.5 |
| 140 ~ 160                                    | 1.3                                                             | 1.4 | 1.8 | 2.0 | 2.0 | 2.2 | 2.4 | 2.9 | 3.0 | 3.6 | 4.2 | 5.6 |
| 160 ~ 180                                    | 1.2                                                             | 1.4 | 1.8 | 2.0 | 2.0 | 2.2 | 2.4 | 2.9 | 3.0 | 3.6 | 4.3 | 5.8 |

OHARA 25-04

## S-TIL 6

Code(d) 532489

Code(e) 534485

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.531 72<br>1.531 717 | Abbe Number $\nu_d$ | 48.84 | Dispersion $n_F - n_C$       | 0.010 887 |
| Refractive Index $n_e$ | 1.534 304             | Abbe Number $\nu_e$ | 48.55 | Dispersion $n_{F'} - n_{C'}$ | 0.011 006 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.502 92 |
| $n_{1970}$         | 1.970 09  | 1.507 97 |
| $n_{1530}$         | 1.529 58  | 1.513 42 |
| $n_{1129}$         | 1.128 64  | 1.518 29 |
| $n_t$              | 1.013 98  | 1.519 93 |
| $n_s$              | 0.852 11  | 1.522 80 |
| $n_{A'}$           | 0.768 19  | 1.524 79 |
| $n_F$              | 0.706 52  | 1.526 62 |
| $n_C$              | 0.656 27  | 1.528 46 |
| $n_{C'}$           | 0.643 85  | 1.528 97 |
| $n_{He-Ne}$        | 0.632 8   | 1.529 46 |
| $n_D$              | 0.589 29  | 1.531 62 |
| $n_d$              | 0.587 56  | 1.531 72 |
| $n_e$              | 0.546 07  | 1.534 30 |
| $n_F$              | 0.486 13  | 1.539 34 |
| $n_{F'}$           | 0.479 99  | 1.539 98 |
| $n_{He-Cd}$        | 0.441 57  | 1.544 65 |
| $n_g$              | 0.435 835 | 1.545 47 |
| $n_h$              | 0.404 656 | 1.550 69 |
| $n_i$              | 0.365 015 | 1.559 89 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.177 017 77E+00 |
| $A_2$                           | 1.279 580 30E-01 |
| $A_3$                           | 1.347 401 24E+00 |
| $B_1$                           | 7.710 876 86E-03 |
| $B_2$                           | 4.113 253 28E-02 |
| $B_3$                           | 1.545 316 92E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 3   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2~3 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 64.8  |
| Rigidity Modulus G (GPa) | 28.3  |
| Poisson's Ratio $\sigma$ | 0.146 |
| Knoop Hardness Hk[Class] | 490   |
| Abrasion Aa              | 121   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.008 529 |
| $n_C - n_{A'}$      | 0.003 667 |
| $n_d - n_C$         | 0.003 261 |
| $n_e - n_C$         | 0.005 848 |
| $n_g - n_d$         | 0.013 756 |
| $n_g - n_F$         | 0.006 130 |
| $n_h - n_g$         | 0.005 216 |
| $n_i - n_g$         | 0.014 418 |
| $n_{C'} - n_t$      | 0.009 045 |
| $n_e - n_{C'}$      | 0.005 332 |
| $n_{F'} - n_e$      | 0.005 674 |
| $n_i - n_{F'}$      | 0.019 913 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.783 4 |
| $\theta_{C,A'}$              | 0.336 8 |
| $\theta_{d,C}$               | 0.299 5 |
| $\theta_{e,C}$               | 0.537 2 |
| $\theta_{g,d}$               | 1.263 5 |
| $\theta_{g,F}$               | 0.563 1 |
| $\theta_{h,g}$               | 0.479 1 |
| $\theta_{i,g}$               | 1.324 3 |
| $\theta'_{C,t}$              | 0.821 8 |
| $\theta'_{e,C'}$             | 0.484 5 |
| $\theta'_{F',e}$             | 0.515 5 |
| $\theta'_{i,F'}$             | 1.809 3 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.007 6 |
| $\Delta\theta_{C,A'}$ | 0.001 7 |
| $\Delta\theta_{g,d}$  | 0.000 2 |
| $\Delta\theta_{g,F}$  | 0.000 7 |
| $\Delta\theta_{i,g}$  | 0.008 2 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 365  | $\lambda_5$      | 335 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 364  | $\lambda_{0.05}$ | 339 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.28 | 0.24             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    | 0.07             |
| 350                    | 0.44             |
| 360                    | 0.74             |
| 370                    | 0.88             |
| 380                    | 0.948            |
| 390                    | 0.973            |
| 400                    | 0.985            |
| 420                    | 0.990            |
| 440                    | 0.989            |
| 460                    | 0.990            |
| 480                    | 0.991            |
| 500                    | 0.993            |
| 550                    | 0.994            |
| 600                    | 0.994            |
| 650                    | 0.992            |
| 700                    | 0.996            |
| 800                    | 0.998            |
| 900                    | 0.997            |
| 1 000                  | 0.997            |
| 1 200                  | 0.996            |
| 1 400                  | 0.995            |
| 1 600                  | 0.993            |
| 1 800                  | 0.977            |
| 2 000                  | 0.947            |
| 2 200                  | 0.89             |
| 2 400                  | 0.85             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 438  |
| Annealing Point AP (°C)                                          | 468  |
| Transformation Temperature Tg (°C)                               | 478  |
| Yield Point At (°C)                                              | 552  |
| Softening Point SP (°C)                                          | 648  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 83   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 101  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.06 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 67                                             |
| -90 ~ -80                               | 69                                             |
| -80 ~ -70                               | 71                                             |
| -70 ~ -60                               | 72                                             |
| -60 ~ -50                               | 74                                             |
| -50 ~ -40                               | 75                                             |
| -40 ~ -30                               | 77                                             |
| -30 ~ -20                               | 78                                             |
| -20 ~ -10                               | 80                                             |
| -10 ~ 0                                 | 81                                             |
| 0 ~ 10                                  | 83                                             |
| 10 ~ 20                                 | 84                                             |
| 20 ~ 30                                 | 85                                             |
| 30 ~ 40                                 | 87                                             |
| 40 ~ 50                                 | 88                                             |
| 50 ~ 60                                 | 89                                             |
| 60 ~ 70                                 | 90                                             |
| 70 ~ 80                                 | 91                                             |
| 80 ~ 90                                 | 92                                             |
| 90 ~ 100                                | 93                                             |
| 100 ~ 110                               | 94                                             |
| 110 ~ 120                               | 95                                             |
| 120 ~ 130                               | 96                                             |
| 130 ~ 140                               | 97                                             |
| 140 ~ 150                               | 98                                             |
| 150 ~ 160                               | 98                                             |
| 160 ~ 170                               | 99                                             |
| 170 ~ 180                               | 100                                            |
| 180 ~ 190                               | 100                                            |
| 190 ~ 200                               | 101                                            |
| 200 ~ 210                               | 102                                            |
| 210 ~ 220                               | 102                                            |
| 220 ~ 230                               | 103                                            |
| 230 ~ 240                               | 103                                            |
| 240 ~ 250                               | 103                                            |
| 250 ~ 260                               | 104                                            |
| 260 ~ 270                               | 104                                            |
| 270 ~ 280                               | 104                                            |
| 280 ~ 290                               | 105                                            |
| 290 ~ 300                               | 105                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.81 |
| Specific Gravity $d$                                     | 2.50 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.0                                                             | 1.1 | 1.4 | 1.5 | 1.5 | 1.7 | 1.8 | 2.1 | 2.1 | 2.5 | 3.0 | 3.8 |
| -60 ~ -40                                    | 0.8                                                             | 0.9 | 1.3 | 1.4 | 1.4 | 1.5 | 1.7 | 2.0 | 2.0 | 2.4 | 2.8 | 3.8 |
| -40 ~ -20                                    | 0.7                                                             | 0.8 | 1.2 | 1.3 | 1.3 | 1.5 | 1.6 | 1.9 | 2.0 | 2.4 | 2.8 | 3.8 |
| -20 ~ 0                                      | 0.7                                                             | 0.8 | 1.2 | 1.3 | 1.3 | 1.5 | 1.6 | 2.0 | 2.0 | 2.4 | 2.9 | 3.9 |
| 0 ~ 20                                       | 0.7                                                             | 0.9 | 1.2 | 1.3 | 1.3 | 1.4 | 1.6 | 2.0 | 2.0 | 2.6 | 3.0 | 4.0 |
| 20 ~ 40                                      | 0.8                                                             | 0.9 | 1.2 | 1.3 | 1.3 | 1.5 | 1.7 | 2.2 | 2.2 | 2.7 | 3.1 | 4.1 |
| 40 ~ 60                                      | 0.9                                                             | 1.0 | 1.3 | 1.4 | 1.5 | 1.7 | 1.8 | 2.2 | 2.3 | 2.7 | 3.2 | 4.3 |
| 60 ~ 80                                      | 0.8                                                             | 1.0 | 1.3 | 1.4 | 1.5 | 1.7 | 2.0 | 2.3 | 2.4 | 2.9 | 3.4 | 4.5 |
| 80 ~ 100                                     | 0.9                                                             | 1.1 | 1.4 | 1.5 | 1.6 | 1.8 | 1.9 | 2.4 | 2.4 | 3.0 | 3.6 | 4.6 |
| 100 ~ 120                                    | 0.9                                                             | 1.1 | 1.5 | 1.6 | 1.6 | 1.8 | 2.0 | 2.4 | 2.5 | 3.1 | 3.7 | 4.8 |
| 120 ~ 140                                    | 1.0                                                             | 1.1 | 1.6 | 1.6 | 1.7 | 2.0 | 2.2 | 2.6 | 2.7 | 3.2 | 3.8 | 4.9 |
| 140 ~ 160                                    | 1.0                                                             | 1.2 | 1.6 | 1.7 | 1.8 | 2.0 | 2.2 | 2.6 | 2.7 | 3.2 | 3.8 | 5.0 |
| 160 ~ 180                                    | 1.0                                                             | 1.2 | 1.6 | 1.7 | 1.8 | 2.0 | 2.2 | 2.7 | 2.7 | 3.3 | 3.9 | 5.1 |

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## S-TIL25

Code(d) **581407**  
Code(e) **585405**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.581 44</b><br>1.581 439 | Abbe Number $\nu_d$ | <b>40.75</b> | Dispersion $n_F - n_C$       | <b>0.014 270</b> |
| Refractive Index $n_e$ | 1.584 822                    | Abbe Number $\nu_e$ | 40.47        | Dispersion $n_{F'} - n_{C'}$ | 0.014 451        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.547 41 |
| $n_{1970}$         | 1.970 09  | 1.552 92 |
| $n_{1530}$         | 1.529 58  | 1.558 95 |
| $n_{1129}$         | 1.128 64  | 1.564 56 |
| $n_t$              | 1.013 98  | 1.566 51 |
| $n_s$              | 0.852 11  | 1.570 05 |
| $n_{A'}$           | 0.768 19  | 1.572 54 |
| $n_F$              | 0.706 52  | 1.574 86 |
| $n_C$              | 0.656 27  | 1.577 22 |
| $n_{C'}$           | 0.643 85  | 1.577 88 |
| $n_{He-Ne}$        | 0.632 8   | 1.578 50 |
| $n_D$              | 0.589 29  | 1.581 31 |
| $n_d$              | 0.587 56  | 1.581 44 |
| $n_e$              | 0.546 07  | 1.584 82 |
| $n_F$              | 0.486 13  | 1.591 49 |
| $n_{F'}$           | 0.479 99  | 1.592 33 |
| $n_{He-Cd}$        | 0.441 57  | 1.598 61 |
| $n_g$              | 0.435 835 | 1.599 73 |
| $n_h$              | 0.404 656 | 1.606 87 |
| $n_i$              | 0.365 015 | 1.619 79 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.321 225 34E+00 |
| $A_2$                           | 1.238 249 76E-01 |
| $A_3$                           | 1.436 852 54E+00 |
| $B_1$                           | 9.520 914 36E-03 |
| $B_2$                           | 5.160 626 65E-02 |
| $B_3$                           | 1.490 648 83E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 75.3  |   |
| Rigidity Modulus G (GPa) | 30.9  |   |
| Poisson's Ratio $\sigma$ | 0.220 |   |
| Knoop Hardness Hk[Class] | 540   | 5 |
| Abrasion Aa              | 117   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 703 |
| $n_C - n_{A'}$      | 0.004 679 |
| $n_d - n_C$         | 0.004 223 |
| $n_e - n_C$         | 0.007 606 |
| $n_g - n_d$         | 0.018 287 |
| $n_g - n_F$         | 0.008 240 |
| $n_h - n_g$         | 0.007 140 |
| $n_i - n_g$         | 0.020 066 |
| $n_{C'} - n_t$      | 0.011 368 |
| $n_e - n_{C'}$      | 0.006 941 |
| $n_{F'} - n_e$      | 0.007 510 |
| $n_i - n_{F'}$      | 0.027 460 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.750 0 |
| $\theta_{C,A'}$              | 0.327 9 |
| $\theta_{d,C}$               | 0.295 9 |
| $\theta_{e,C}$               | 0.533 0 |
| $\theta_{g,d}$               | 1.281 5 |
| $\theta_{g,F}$               | 0.577 4 |
| $\theta_{h,g}$               | 0.500 4 |
| $\theta_{i,g}$               | 1.406 2 |
| $\theta'_{C,t}$              | 0.786 7 |
| $\theta'_{e,C'}$             | 0.480 3 |
| $\theta'_{F',e}$             | 0.519 7 |
| $\theta'_{i,F'}$             | 1.900 2 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.012 1 |
| $\Delta\theta_{C,A'}$ | 0.002 7 |
| $\Delta\theta_{g,d}$  | 0.001 4 |
| $\Delta\theta_{g,F}$  | 0.001 9 |
| $\Delta\theta_{i,g}$  | 0.022 4 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 380  | $\lambda_5$      | 350 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 378  | $\lambda_{0.05}$ | 351 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.73 | 0.73             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.01             |
| 360                    | 0.28             |
| 370                    | 0.65             |
| 380                    | 0.85             |
| 390                    | 0.929            |
| 400                    | 0.964            |
| 420                    | 0.986            |
| 440                    | 0.991            |
| 460                    | 0.993            |
| 480                    | 0.994            |
| 500                    | 0.995            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.994            |
| 1 600                  | 0.994            |
| 1 800                  | 0.981            |
| 2 000                  | 0.963            |
| 2 200                  | 0.911            |
| 2 400                  | 0.89             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 536  |
| Annealing Point AP (°C)                                          | 564  |
| Transformation Temperature Tg (°C)                               | 590  |
| Yield Point At (°C)                                              | 631  |
| Softening Point SP (°C)                                          | 715  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 75   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 90   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.05 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 61                                             |
| -90 ~ -80                               | 62                                             |
| -80 ~ -70                               | 63                                             |
| -70 ~ -60                               | 65                                             |
| -60 ~ -50                               | 66                                             |
| -50 ~ -40                               | 68                                             |
| -40 ~ -30                               | 69                                             |
| -30 ~ -20                               | 70                                             |
| -20 ~ -10                               | 71                                             |
| -10 ~ 0                                 | 73                                             |
| 0 ~ 10                                  | 74                                             |
| 10 ~ 20                                 | 75                                             |
| 20 ~ 30                                 | 76                                             |
| 30 ~ 40                                 | 77                                             |
| 40 ~ 50                                 | 78                                             |
| 50 ~ 60                                 | 79                                             |
| 60 ~ 70                                 | 80                                             |
| 70 ~ 80                                 | 81                                             |
| 80 ~ 90                                 | 82                                             |
| 90 ~ 100                                | 83                                             |
| 100 ~ 110                               | 84                                             |
| 110 ~ 120                               | 85                                             |
| 120 ~ 130                               | 85                                             |
| 130 ~ 140                               | 86                                             |
| 140 ~ 150                               | 87                                             |
| 150 ~ 160                               | 88                                             |
| 160 ~ 170                               | 88                                             |
| 170 ~ 180                               | 89                                             |
| 180 ~ 190                               | 89                                             |
| 190 ~ 200                               | 90                                             |
| 200 ~ 210                               | 91                                             |
| 210 ~ 220                               | 91                                             |
| 220 ~ 230                               | 91                                             |
| 230 ~ 240                               | 92                                             |
| 240 ~ 250                               | 92                                             |
| 250 ~ 260                               | 93                                             |
| 260 ~ 270                               | 93                                             |
| 270 ~ 280                               | 93                                             |
| 280 ~ 290                               | 94                                             |
| 290 ~ 300                               | 94                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.84 |
| Specific Gravity $d$                                      | 2.59 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 2.2                                                             | 2.3 | 2.6 | 2.8 | 2.8 | 3.0 | 3.2 | 3.6 | 3.6 | 4.2 | 4.8 | 6.0 |
| -60 ~ -40                                    | 2.0                                                             | 2.1 | 2.4 | 2.6 | 2.6 | 2.8 | 3.1 | 3.5 | 3.5 | 4.0 | 4.6 | 6.0 |
| -40 ~ -20                                    | 1.9                                                             | 2.0 | 2.4 | 2.5 | 2.5 | 2.8 | 3.0 | 3.4 | 3.5 | 4.1 | 4.7 | 6.1 |
| -20 ~ 0                                      | 1.9                                                             | 2.0 | 2.4 | 2.5 | 2.5 | 2.7 | 2.9 | 3.5 | 3.6 | 4.1 | 4.8 | 6.2 |
| 0 ~ 20                                       | 1.8                                                             | 2.1 | 2.5 | 2.6 | 2.6 | 2.9 | 3.1 | 3.5 | 3.6 | 4.2 | 4.9 | 6.5 |
| 20 ~ 40                                      | 1.9                                                             | 2.1 | 2.5 | 2.7 | 2.7 | 2.9 | 3.2 | 3.6 | 3.7 | 4.3 | 5.0 | 6.7 |
| 40 ~ 60                                      | 2.0                                                             | 2.2 | 2.6 | 2.7 | 2.8 | 3.0 | 3.2 | 3.7 | 3.8 | 4.5 | 5.3 | 6.9 |
| 60 ~ 80                                      | 2.0                                                             | 2.3 | 2.7 | 2.9 | 2.9 | 3.1 | 3.4 | 3.9 | 4.0 | 4.7 | 5.4 | 7.1 |
| 80 ~ 100                                     | 2.1                                                             | 2.3 | 2.8 | 3.0 | 3.0 | 3.2 | 3.5 | 4.0 | 4.1 | 4.8 | 5.6 | 7.3 |
| 100 ~ 120                                    | 2.1                                                             | 2.3 | 2.8 | 3.0 | 3.1 | 3.3 | 3.6 | 4.2 | 4.3 | 5.0 | 5.8 | 7.6 |
| 120 ~ 140                                    | 2.3                                                             | 2.5 | 2.9 | 3.1 | 3.1 | 3.4 | 3.7 | 4.3 | 4.4 | 5.1 | 6.0 | 7.8 |
| 140 ~ 160                                    | 2.3                                                             | 2.5 | 3.0 | 3.1 | 3.2 | 3.5 | 3.7 | 4.4 | 4.4 | 5.2 | 6.1 | 8.0 |
| 160 ~ 180                                    | 2.2                                                             | 2.5 | 3.0 | 3.2 | 3.2 | 3.5 | 3.8 | 4.5 | 4.6 | 5.4 | 6.3 | 8.2 |

OHARA 25-04

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.567 32</b><br>1.567 322 | Abbe Number $\nu_d$ | <b>42.82</b> | Dispersion $n_F - n_C$       | <b>0.013 250</b> |
| Refractive Index $n_e$ | 1.570 466                    | Abbe Number $\nu_e$ | 42.54        | Dispersion $n_{F'} - n_{C'}$ | 0.013 411        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.534 93 |
| $n_{1970}$         | 1.970 09  | 1.540 28 |
| $n_{1530}$         | 1.529 58  | 1.546 11 |
| $n_{1129}$         | 1.128 64  | 1.551 48 |
| $n_t$              | 1.013 98  | 1.553 33 |
| $n_s$              | 0.852 11  | 1.556 67 |
| $n_{A'}$           | 0.768 19  | 1.559 01 |
| $n_F$              | 0.706 52  | 1.561 19 |
| $n_C$              | 0.656 27  | 1.563 39 |
| $n_{C'}$           | 0.643 85  | 1.564 01 |
| $n_{He-Ne}$        | 0.632 8   | 1.564 59 |
| $n_D$              | 0.589 29  | 1.567 21 |
| $n_d$              | 0.587 56  | 1.567 32 |
| $n_e$              | 0.546 07  | 1.570 47 |
| $n_F$              | 0.486 13  | 1.576 64 |
| $n_{F'}$           | 0.479 99  | 1.577 42 |
| $n_{He-Cd}$        | 0.441 57  | 1.583 21 |
| $n_g$              | 0.435 835 | 1.584 23 |
| $n_h$              | 0.404 656 | 1.590 77 |
| $n_i$              | 0.365 015 | 1.602 56 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.310 664 88E+00 |
| $A_2$                           | 9.419 030 94E-02 |
| $A_3$                           | 1.232 926 44E+00 |
| $B_1$                           | 9.688 978 12E-03 |
| $B_2$                           | 5.277 631 06E-02 |
| $B_3$                           | 1.332 964 22E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 73.9  |
| Rigidity Modulus G (GPa) | 30.2  |
| Poisson's Ratio $\sigma$ | 0.222 |
| Knoop Hardness Hk[Class] | 500   |
| Abrasion Aa              | 120   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 055 |
| $n_C - n_{A'}$      | 0.004 379 |
| $n_d - n_C$         | 0.003 936 |
| $n_e - n_C$         | 0.007 080 |
| $n_g - n_d$         | 0.016 907 |
| $n_g - n_F$         | 0.007 593 |
| $n_h - n_g$         | 0.006 546 |
| $n_i - n_g$         | 0.018 329 |
| $n_{C'} - n_t$      | 0.010 676 |
| $n_e - n_{C'}$      | 0.006 459 |
| $n_{F'} - n_e$      | 0.006 952 |
| $n_i - n_{F'}$      | 0.025 140 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.758 9 |
| $\theta_{C,A'}$              | 0.330 5 |
| $\theta_{d,C}$               | 0.297 1 |
| $\theta_{e,C}$               | 0.534 3 |
| $\theta_{g,d}$               | 1.276 0 |
| $\theta_{g,F}$               | 0.573 1 |
| $\theta_{h,g}$               | 0.494 0 |
| $\theta_{i,g}$               | 1.383 3 |
| $\theta'_{C,t}$              | 0.796 1 |
| $\theta'_{e,C'}$             | 0.481 6 |
| $\theta'_{F,e}$              | 0.518 4 |
| $\theta'_{i,F'}$             | 1.874 6 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.011 3 |
| $\Delta\theta_{C,A'}$ | 0.002 7 |
| $\Delta\theta_{g,d}$  | 0.000 2 |
| $\Delta\theta_{g,F}$  | 0.000 9 |
| $\Delta\theta_{i,g}$  | 0.016 8 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 380  | $\lambda_5$      | 345 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 374  | $\lambda_{0.05}$ | 349 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.56 | 0.54             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.07             |
| 360                    | 0.44             |
| 370                    | 0.74             |
| 380                    | 0.88             |
| 390                    | 0.945            |
| 400                    | 0.971            |
| 420                    | 0.989            |
| 440                    | 0.993            |
| 460                    | 0.995            |
| 480                    | 0.995            |
| 500                    | 0.997            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.997            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.995            |
| 1 600                  | 0.993            |
| 1 800                  | 0.977            |
| 2 000                  | 0.950            |
| 2 200                  | 0.89             |
| 2 400                  | 0.86             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 495  |
| Annealing Point AP (°C)                                          | 533  |
| Transformation Temperature Tg (°C)                               | 556  |
| Yield Point At (°C)                                              | 616  |
| Softening Point SP (°C)                                          | 694  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 78   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 95   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.05 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 62                                             |
| -90 ~ -80                               | 63                                             |
| -80 ~ -70                               | 65                                             |
| -70 ~ -60                               | 67                                             |
| -60 ~ -50                               | 68                                             |
| -50 ~ -40                               | 70                                             |
| -40 ~ -30                               | 71                                             |
| -30 ~ -20                               | 73                                             |
| -20 ~ -10                               | 74                                             |
| -10 ~ 0                                 | 75                                             |
| 0 ~ 10                                  | 77                                             |
| 10 ~ 20                                 | 78                                             |
| 20 ~ 30                                 | 79                                             |
| 30 ~ 40                                 | 80                                             |
| 40 ~ 50                                 | 82                                             |
| 50 ~ 60                                 | 83                                             |
| 60 ~ 70                                 | 84                                             |
| 70 ~ 80                                 | 85                                             |
| 80 ~ 90                                 | 86                                             |
| 90 ~ 100                                | 87                                             |
| 100 ~ 110                               | 88                                             |
| 110 ~ 120                               | 89                                             |
| 120 ~ 130                               | 90                                             |
| 130 ~ 140                               | 91                                             |
| 140 ~ 150                               | 91                                             |
| 150 ~ 160                               | 92                                             |
| 160 ~ 170                               | 93                                             |
| 170 ~ 180                               | 94                                             |
| 180 ~ 190                               | 94                                             |
| 190 ~ 200                               | 95                                             |
| 200 ~ 210                               | 95                                             |
| 210 ~ 220                               | 96                                             |
| 220 ~ 230                               | 96                                             |
| 230 ~ 240                               | 97                                             |
| 240 ~ 250                               | 97                                             |
| 250 ~ 260                               | 98                                             |
| 260 ~ 270                               | 98                                             |
| 270 ~ 280                               | 98                                             |
| 280 ~ 290                               | 99                                             |
| 290 ~ 300                               | 99                                             |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.75 |
| Specific Gravity $d$                                     | 2.57 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.8                                                             | 1.9 | 2.2 | 2.3 | 2.3 | 2.5 | 2.7 | 3.1 | 3.1 | 3.6 | 4.2 | 5.4 |
| -60 ~ -40                                    | 1.7                                                             | 1.8 | 2.1 | 2.2 | 2.2 | 2.4 | 2.6 | 3.1 | 3.1 | 3.6 | 4.2 | 5.5 |
| -40 ~ -20                                    | 1.6                                                             | 1.8 | 2.1 | 2.2 | 2.2 | 2.4 | 2.6 | 3.1 | 3.2 | 3.7 | 4.3 | 5.6 |
| -20 ~ 0                                      | 1.6                                                             | 1.8 | 2.1 | 2.3 | 2.3 | 2.5 | 2.7 | 3.1 | 3.2 | 3.8 | 4.5 | 5.8 |
| 0 ~ 20                                       | 1.6                                                             | 1.8 | 2.3 | 2.4 | 2.4 | 2.6 | 2.8 | 3.3 | 3.4 | 3.9 | 4.6 | 6.0 |
| 20 ~ 40                                      | 1.7                                                             | 1.9 | 2.4 | 2.5 | 2.5 | 2.7 | 3.0 | 3.4 | 3.5 | 4.1 | 4.8 | 6.3 |
| 40 ~ 60                                      | 1.9                                                             | 2.0 | 2.4 | 2.6 | 2.6 | 2.8 | 3.1 | 3.6 | 3.6 | 4.3 | 5.0 | 6.6 |
| 60 ~ 80                                      | 1.9                                                             | 2.0 | 2.6 | 2.7 | 2.7 | 3.0 | 3.2 | 3.7 | 3.8 | 4.5 | 5.2 | 6.8 |
| 80 ~ 100                                     | 1.9                                                             | 2.1 | 2.6 | 2.7 | 2.8 | 3.1 | 3.3 | 3.9 | 4.0 | 4.7 | 5.4 | 7.1 |
| 100 ~ 120                                    | 2.0                                                             | 2.2 | 2.6 | 2.8 | 2.8 | 3.2 | 3.4 | 4.0 | 4.1 | 4.8 | 5.6 | 7.4 |
| 120 ~ 140                                    | 2.0                                                             | 2.3 | 2.8 | 2.9 | 3.0 | 3.2 | 3.5 | 4.1 | 4.2 | 4.9 | 5.7 | 7.6 |
| 140 ~ 160                                    | 2.1                                                             | 2.3 | 2.8 | 2.9 | 3.0 | 3.3 | 3.5 | 4.1 | 4.2 | 5.0 | 5.9 | 7.8 |
| 160 ~ 180                                    | 2.0                                                             | 2.3 | 2.8 | 2.9 | 3.0 | 3.3 | 3.5 | 4.2 | 4.3 | 5.2 | 6.0 | 8.0 |

## S-TIL27

Code(d) 575415

Code(e) 578412

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.575 01<br>1.575 006 | Abbe Number $\nu_d$ | 41.50 | Dispersion $n_F - n_C$       | 0.013 854 |
| Refractive Index $n_e$ | 1.578 291             | Abbe Number $\nu_e$ | 41.22 | Dispersion $n_{F'} - n_{C'}$ | 0.014 028 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.541 62 |
| $n_{1970}$         | 1.970 09  | 1.547 07 |
| $n_{1530}$         | 1.529 58  | 1.553 04 |
| $n_{1129}$         | 1.128 64  | 1.558 55 |
| $n_t$              | 1.013 98  | 1.560 47 |
| $n_s$              | 0.852 11  | 1.563 92 |
| $n_{A'}$           | 0.768 19  | 1.566 35 |
| $n_F$              | 0.706 52  | 1.568 61 |
| $n_C$              | 0.656 27  | 1.570 90 |
| $n_{C'}$           | 0.643 85  | 1.571 55 |
| $n_{He-Ne}$        | 0.632 8   | 1.572 16 |
| $n_D$              | 0.589 29  | 1.574 88 |
| $n_d$              | 0.587 56  | 1.575 01 |
| $n_e$              | 0.546 07  | 1.578 29 |
| $n_F$              | 0.486 13  | 1.584 76 |
| $n_{F'}$           | 0.479 99  | 1.585 58 |
| $n_{He-Cd}$        | 0.441 57  | 1.591 67 |
| $n_g$              | 0.435 835 | 1.592 75 |
| $n_h$              | 0.404 656 | 1.599 66 |
| $n_i$              | 0.365 015 | 1.612 18 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.314 331 54E+00 |
| $A_2$                           | 1.123 001 68E-01 |
| $A_3$                           | 1.413 901 00E+00 |
| $B_1$                           | 9.504 044 77E-03 |
| $B_2$                           | 5.241 127 72E-02 |
| $B_3$                           | 1.484 299 72E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 74.9  |
| Rigidity Modulus G (GPa) | 30.8  |
| Poisson's Ratio $\sigma$ | 0.217 |
| Knoop Hardness Hk[Class] | 540 5 |
| Abrasion Aa              | 125   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.010 433 |
| $n_C - n_{A'}$      | 0.004 553 |
| $n_d - n_C$         | 0.004 104 |
| $n_e - n_C$         | 0.007 389 |
| $n_g - n_d$         | 0.017 739 |
| $n_g - n_F$         | 0.007 989 |
| $n_h - n_g$         | 0.006 918 |
| $n_i - n_g$         | 0.019 440 |
| $n_{C'} - n_t$      | 0.011 080 |
| $n_e - n_{C'}$      | 0.006 742 |
| $n_{F'} - n_e$      | 0.007 286 |
| $n_i - n_{F'}$      | 0.026 608 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.753 1 |
| $\theta_{C,A'}$              | 0.328 6 |
| $\theta_{d,C}$               | 0.296 2 |
| $\theta_{e,C}$               | 0.533 3 |
| $\theta_{g,d}$               | 1.280 4 |
| $\theta_{g,F}$               | 0.576 7 |
| $\theta_{h,g}$               | 0.499 4 |
| $\theta_{i,g}$               | 1.403 2 |
| $\theta'_{C,t}$              | 0.789 8 |
| $\theta'_{e,C'}$             | 0.480 6 |
| $\theta'_{F',e}$             | 0.519 4 |
| $\theta'_{i,F'}$             | 1.896 8 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.011 7 |
| $\Delta\theta_{C,A'}$ | 0.002 4 |
| $\Delta\theta_{g,d}$  | 0.001 9 |
| $\Delta\theta_{g,F}$  | 0.002 4 |
| $\Delta\theta_{i,g}$  | 0.025 7 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 380  | $\lambda_5$      | 350 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 371  | $\lambda_{0.05}$ | 350 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.45 | 0.47             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.05             |
| 360                    | 0.44             |
| 370                    | 0.78             |
| 380                    | 0.913            |
| 390                    | 0.961            |
| 400                    | 0.979            |
| 420                    | 0.990            |
| 440                    | 0.993            |
| 460                    | 0.994            |
| 480                    | 0.995            |
| 500                    | 0.996            |
| 550                    | 0.998            |
| 600                    | 0.998            |
| 650                    | 0.998            |
| 700                    | 0.998            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.994            |
| 1 600                  | 0.993            |
| 1 800                  | 0.978            |
| 2 000                  | 0.955            |
| 2 200                  | 0.89             |
| 2 400                  | 0.87             |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 511  |
| Annealing Point AP (°C)                                          | 547  |
| Transformation Temperature Tg (°C)                               | 566  |
| Yield Point At (°C)                                              | 623  |
| Softening Point SP (°C)                                          | 700  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 76   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 91   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.07 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 61                                             |
| -90 ~ -80                               | 62                                             |
| -80 ~ -70                               | 64                                             |
| -70 ~ -60                               | 65                                             |
| -60 ~ -50                               | 67                                             |
| -50 ~ -40                               | 68                                             |
| -40 ~ -30                               | 69                                             |
| -30 ~ -20                               | 71                                             |
| -20 ~ -10                               | 72                                             |
| -10 ~ 0                                 | 73                                             |
| 0 ~ 10                                  | 75                                             |
| 10 ~ 20                                 | 76                                             |
| 20 ~ 30                                 | 77                                             |
| 30 ~ 40                                 | 78                                             |
| 40 ~ 50                                 | 79                                             |
| 50 ~ 60                                 | 80                                             |
| 60 ~ 70                                 | 81                                             |
| 70 ~ 80                                 | 82                                             |
| 80 ~ 90                                 | 83                                             |
| 90 ~ 100                                | 84                                             |
| 100 ~ 110                               | 85                                             |
| 110 ~ 120                               | 86                                             |
| 120 ~ 130                               | 87                                             |
| 130 ~ 140                               | 87                                             |
| 140 ~ 150                               | 88                                             |
| 150 ~ 160                               | 89                                             |
| 160 ~ 170                               | 90                                             |
| 170 ~ 180                               | 90                                             |
| 180 ~ 190                               | 91                                             |
| 190 ~ 200                               | 92                                             |
| 200 ~ 210                               | 92                                             |
| 210 ~ 220                               | 93                                             |
| 220 ~ 230                               | 93                                             |
| 230 ~ 240                               | 94                                             |
| 240 ~ 250                               | 94                                             |
| 250 ~ 260                               | 95                                             |
| 260 ~ 270                               | 95                                             |
| 270 ~ 280                               | 95                                             |
| 280 ~ 290                               | 96                                             |
| 290 ~ 300                               | 96                                             |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.81 |
| Specific Gravity $d$                                      | 2.58 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.7                                                             | 1.8 | 2.1 | 2.3 | 2.3 | 2.6 | 2.7 | 3.1 | 3.2 | 3.7 | 4.4 | 5.6 |
| -60 ~ -40                                    | 1.6                                                             | 1.8 | 2.1 | 2.2 | 2.2 | 2.4 | 2.7 | 3.1 | 3.2 | 3.7 | 4.3 | 5.8 |
| -40 ~ -20                                    | 1.6                                                             | 1.8 | 2.1 | 2.2 | 2.2 | 2.4 | 2.6 | 3.2 | 3.2 | 3.8 | 4.4 | 5.8 |
| -20 ~ 0                                      | 1.6                                                             | 1.8 | 2.1 | 2.3 | 2.3 | 2.5 | 2.7 | 3.3 | 3.3 | 3.9 | 4.6 | 6.0 |
| 0 ~ 20                                       | 1.6                                                             | 1.8 | 2.3 | 2.4 | 2.4 | 2.7 | 2.9 | 3.4 | 3.4 | 4.0 | 4.7 | 6.3 |
| 20 ~ 40                                      | 1.7                                                             | 1.9 | 2.4 | 2.5 | 2.6 | 2.8 | 3.0 | 3.5 | 3.6 | 4.2 | 4.9 | 6.6 |
| 40 ~ 60                                      | 1.8                                                             | 2.0 | 2.4 | 2.6 | 2.6 | 2.8 | 3.1 | 3.6 | 3.7 | 4.3 | 5.2 | 6.8 |
| 60 ~ 80                                      | 1.9                                                             | 2.1 | 2.6 | 2.7 | 2.8 | 3.0 | 3.2 | 3.8 | 3.8 | 4.5 | 5.3 | 7.0 |
| 80 ~ 100                                     | 1.9                                                             | 2.1 | 2.6 | 2.8 | 2.8 | 3.1 | 3.4 | 3.9 | 4.0 | 4.7 | 5.5 | 7.2 |
| 100 ~ 120                                    | 2.0                                                             | 2.2 | 2.6 | 2.8 | 2.8 | 3.2 | 3.4 | 4.0 | 4.1 | 4.8 | 5.6 | 7.4 |
| 120 ~ 140                                    | 2.0                                                             | 2.3 | 2.7 | 2.9 | 2.9 | 3.2 | 3.5 | 4.1 | 4.1 | 4.9 | 5.7 | 7.6 |
| 140 ~ 160                                    | 2.0                                                             | 2.2 | 2.7 | 2.9 | 2.9 | 3.2 | 3.5 | 4.1 | 4.2 | 5.0 | 5.8 | 7.8 |
| 160 ~ 180                                    | 1.9                                                             | 2.2 | 2.7 | 2.8 | 2.9 | 3.2 | 3.4 | 4.1 | 4.3 | 5.1 | 5.9 | 7.9 |

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## S-TIM 2

Code(d) 620363

Code(e) 624360

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.620 04<br>1.620 041 | Abbe Number $\nu_d$ | 36.26 | Dispersion $n_F - n_C$       | 0.017 099 |
| Refractive Index $n_e$ | 1.624 088             | Abbe Number $\nu_e$ | 35.99 | Dispersion $n_{F'} - n_{C'}$ | 0.017 339 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.582 40 |
| $n_{1970}$         | 1.970 09  | 1.588 06 |
| $n_{1530}$         | 1.529 58  | 1.594 35 |
| $n_{1129}$         | 1.128 64  | 1.600 41 |
| $n_t$              | 1.013 98  | 1.602 60 |
| $n_s$              | 0.852 11  | 1.606 63 |
| $n_{A'}$           | 0.768 19  | 1.609 52 |
| $n_F$              | 0.706 52  | 1.612 25 |
| $n_C$              | 0.656 27  | 1.615 02 |
| $n_{C'}$           | 0.643 85  | 1.615 81 |
| $n_{\text{He-Ne}}$ | 0.632 8   | 1.616 55 |
| $n_D$              | 0.589 29  | 1.619 89 |
| $n_d$              | 0.587 56  | 1.620 04 |
| $n_e$              | 0.546 07  | 1.624 09 |
| $n_F$              | 0.486 13  | 1.632 12 |
| $n_{F'}$           | 0.479 99  | 1.633 15 |
| $n_{\text{He-Cd}}$ | 0.441 57  | 1.640 81 |
| $n_g$              | 0.435 835 | 1.642 18 |
| $n_h$              | 0.404 656 | 1.651 00 |
| $n_i$              | 0.365 015 | 1.667 28 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.421 938 46E+00 |
| $A_2$                           | 1.338 279 68E-01 |
| $A_3$                           | 1.450 605 74E+00 |
| $B_1$                           | 1.072 915 11E-02 |
| $B_2$                           | 5.725 875 46E-02 |
| $B_3$                           | 1.453 818 05E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 77.6  |
| Rigidity Modulus G (GPa) | 31.5  |
| Poisson's Ratio $\sigma$ | 0.230 |
| Knoop Hardness Hk[Class] | 540 5 |
| Abrasion Aa              | 141   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.012 426 |
| $n_C - n_{A'}$      | 0.005 500 |
| $n_d - n_C$         | 0.005 017 |
| $n_e - n_C$         | 0.009 064 |
| $n_g - n_d$         | 0.022 135 |
| $n_g - n_F$         | 0.010 053 |
| $n_h - n_g$         | 0.008 822 |
| $n_i - n_g$         | 0.025 105 |
| $n_{C'} - n_t$      | 0.013 213 |
| $n_e - n_{C'}$      | 0.008 277 |
| $n_{F'} - n_e$      | 0.009 062 |
| $n_i - n_{F'}$      | 0.034 131 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.726 7 |
| $\theta_{C,A'}$              | 0.321 7 |
| $\theta_{d,C}$               | 0.293 4 |
| $\theta_{e,C}$               | 0.530 1 |
| $\theta_{g,d}$               | 1.294 5 |
| $\theta_{g,F}$               | 0.587 9 |
| $\theta_{h,g}$               | 0.515 9 |
| $\theta_{i,g}$               | 1.468 2 |
| $\theta'_{C,t}$              | 0.762 0 |
| $\theta'_{e,C'}$             | 0.477 4 |
| $\theta'_{F',e}$             | 0.522 6 |
| $\theta'_{i,F'}$             | 1.968 5 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.009 9 |
| $\Delta\theta_{C,A'}$ | 0.001 9 |
| $\Delta\theta_{g,d}$  | 0.005 1 |
| $\Delta\theta_{g,F}$  | 0.005 1 |
| $\Delta\theta_{i,g}$  | 0.046 8 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 390  | $\lambda_5$      | 355 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 385  | $\lambda_{0.05}$ | 359 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.20 | 1.19             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.08             |
| 370                    | 0.44             |
| 380                    | 0.73             |
| 390                    | 0.87             |
| 400                    | 0.942            |
| 420                    | 0.978            |
| 440                    | 0.987            |
| 460                    | 0.990            |
| 480                    | 0.992            |
| 500                    | 0.994            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.999            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.995            |
| 1 600                  | 0.995            |
| 1 800                  | 0.984            |
| 2 000                  | 0.971            |
| 2 200                  | 0.930            |
| 2 400                  | 0.914            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 551  |
| Annealing Point AP (°C)                                          | 576  |
| Transformation Temperature Tg (°C)                               | 599  |
| Yield Point At (°C)                                              | 640  |
| Softening Point SP (°C)                                          | 703  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 84   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 101  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.04 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 65                                             |
| -90 ~ -80                               | 67                                             |
| -80 ~ -70                               | 69                                             |
| -70 ~ -60                               | 71                                             |
| -60 ~ -50                               | 73                                             |
| -50 ~ -40                               | 75                                             |
| -40 ~ -30                               | 76                                             |
| -30 ~ -20                               | 78                                             |
| -20 ~ -10                               | 79                                             |
| -10 ~ 0                                 | 81                                             |
| 0 ~ 10                                  | 83                                             |
| 10 ~ 20                                 | 84                                             |
| 20 ~ 30                                 | 85                                             |
| 30 ~ 40                                 | 87                                             |
| 40 ~ 50                                 | 88                                             |
| 50 ~ 60                                 | 89                                             |
| 60 ~ 70                                 | 91                                             |
| 70 ~ 80                                 | 92                                             |
| 80 ~ 90                                 | 93                                             |
| 90 ~ 100                                | 94                                             |
| 100 ~ 110                               | 95                                             |
| 110 ~ 120                               | 96                                             |
| 120 ~ 130                               | 97                                             |
| 130 ~ 140                               | 98                                             |
| 140 ~ 150                               | 99                                             |
| 150 ~ 160                               | 99                                             |
| 160 ~ 170                               | 100                                            |
| 170 ~ 180                               | 101                                            |
| 180 ~ 190                               | 101                                            |
| 190 ~ 200                               | 102                                            |
| 200 ~ 210                               | 102                                            |
| 210 ~ 220                               | 103                                            |
| 220 ~ 230                               | 103                                            |
| 230 ~ 240                               | 104                                            |
| 240 ~ 250                               | 104                                            |
| 250 ~ 260                               | 104                                            |
| 260 ~ 270                               | 104                                            |
| 270 ~ 280                               | 105                                            |
| 280 ~ 290                               | 105                                            |
| 290 ~ 300                               | 105                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.86 |
| Specific Gravity $d$                                     | 2.69 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                        |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{\text{rel}} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                                   | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.0                                                                    | 1.2 | 1.6 | 1.7 | 1.7 | 1.9 | 2.2 | 2.7 | 2.8 | 3.5 | 4.3 | 6.1 |
| -60 ~ -40                                    | 0.9                                                                    | 1.0 | 1.5 | 1.6 | 1.7 | 1.9 | 2.1 | 2.7 | 2.8 | 3.5 | 4.3 | 6.3 |
| -40 ~ -20                                    | 0.8                                                                    | 1.0 | 1.5 | 1.6 | 1.7 | 1.9 | 2.1 | 2.7 | 2.8 | 3.6 | 4.4 | 6.4 |
| -20 ~ 0                                      | 0.9                                                                    | 1.1 | 1.6 | 1.7 | 1.8 | 2.0 | 2.2 | 2.8 | 2.9 | 3.7 | 4.5 | 6.7 |
| 0 ~ 20                                       | 1.0                                                                    | 1.2 | 1.6 | 1.7 | 1.8 | 2.0 | 2.3 | 2.9 | 3.0 | 3.9 | 4.8 | 7.0 |
| 20 ~ 40                                      | 1.0                                                                    | 1.2 | 1.7 | 1.9 | 1.9 | 2.2 | 2.4 | 3.1 | 3.2 | 4.1 | 5.0 | 7.3 |
| 40 ~ 60                                      | 1.1                                                                    | 1.3 | 1.8 | 1.9 | 2.0 | 2.3 | 2.6 | 3.3 | 3.4 | 4.2 | 5.2 | 7.6 |
| 60 ~ 80                                      | 1.2                                                                    | 1.4 | 1.9 | 2.1 | 2.1 | 2.4 | 2.7 | 3.4 | 3.5 | 4.4 | 5.4 | 7.9 |
| 80 ~ 100                                     | 1.2                                                                    | 1.5 | 2.0 | 2.1 | 2.2 | 2.5 | 2.8 | 3.5 | 3.6 | 4.5 | 5.6 | 8.1 |
| 100 ~ 120                                    | 1.3                                                                    | 1.5 | 2.0 | 2.2 | 2.3 | 2.6 | 2.9 | 3.6 | 3.7 | 4.7 | 5.8 | 8.4 |
| 120 ~ 140                                    | 1.3                                                                    | 1.5 | 2.1 | 2.2 | 2.3 | 2.6 | 3.0 | 3.7 | 3.8 | 4.8 | 6.0 | 8.7 |
| 140 ~ 160                                    | 1.2                                                                    | 1.5 | 2.0 | 2.2 | 2.3 | 2.6 | 3.0 | 3.7 | 3.8 | 4.9 | 6.1 | 8.9 |
| 160 ~ 180                                    | 1.1                                                                    | 1.4 | 2.1 | 2.3 | 2.4 | 2.7 | 3.0 | 3.8 | 3.9 | 5.0 | 6.2 | 9.1 |

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## S-TIM 5

Code(d) **603380**  
Code(e) **607378**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.603 42</b><br>1.603 420 | Abbe Number $\nu_d$ | <b>38.03</b> | Dispersion $n_F - n_C$       | <b>0.015 868</b> |
| Refractive Index $n_e$ | 1.607 179                    | Abbe Number $\nu_e$ | 37.76        | Dispersion $n_{F'} - n_{C'}$ | 0.016 082        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.567 53 |
| $n_{1970}$         | 1.970 09  | 1.573 06 |
| $n_{1530}$         | 1.529 58  | 1.579 18 |
| $n_{1129}$         | 1.128 64  | 1.585 00 |
| $n_t$              | 1.013 98  | 1.587 08 |
| $n_s$              | 0.852 11  | 1.590 89 |
| $n_{A'}$           | 0.768 19  | 1.593 60 |
| $n_F$              | 0.706 52  | 1.596 15 |
| $n_C$              | 0.656 27  | 1.598 75 |
| $n_{C'}$           | 0.643 85  | 1.599 48 |
| $n_{He-Ne}$        | 0.632 8   | 1.600 17 |
| $n_D$              | 0.589 29  | 1.603 28 |
| $n_d$              | 0.587 56  | 1.603 42 |
| $n_e$              | 0.546 07  | 1.607 18 |
| $n_F$              | 0.486 13  | 1.614 62 |
| $n_{F'}$           | 0.479 99  | 1.615 56 |
| $n_{He-Cd}$        | 0.441 57  | 1.622 62 |
| $n_g$              | 0.435 835 | 1.623 88 |
| $n_h$              | 0.404 656 | 1.631 96 |
| $n_i$              | 0.365 015 | 1.646 76 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.385 313 42E+00 |
| $A_2$                           | 1.223 729 45E-01 |
| $A_3$                           | 1.405 083 26E+00 |
| $B_1$                           | 1.040 745 67E-02 |
| $B_2$                           | 5.574 400 88E-02 |
| $B_3$                           | 1.448 787 33E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 2   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.2 |

| Mechanical Properties    |       |   |
|--------------------------|-------|---|
| Young's Modulus E (GPa)  | 76.3  |   |
| Rigidity Modulus G (GPa) | 30.9  |   |
| Poisson's Ratio $\sigma$ | 0.233 |   |
| Knoop Hardness Hk[Class] | 540   | 5 |
| Abrasion Aa              | 131   |   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 667 |
| $n_C - n_{A'}$      | 0.005 143 |
| $n_d - n_C$         | 0.004 672 |
| $n_e - n_C$         | 0.008 431 |
| $n_g - n_d$         | 0.020 455 |
| $n_g - n_F$         | 0.009 259 |
| $n_h - n_g$         | 0.008 081 |
| $n_i - n_g$         | 0.022 880 |
| $n_{C'} - n_t$      | 0.012 401 |
| $n_e - n_{C'}$      | 0.007 697 |
| $n_{F'} - n_e$      | 0.008 385 |
| $n_i - n_{F'}$      | 0.031 191 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.735 3 |
| $\theta_{C,A'}$              | 0.324 1 |
| $\theta_{d,C}$               | 0.294 4 |
| $\theta_{e,C}$               | 0.531 3 |
| $\theta_{g,d}$               | 1.289 1 |
| $\theta_{g,F}$               | 0.583 5 |
| $\theta_{h,g}$               | 0.509 3 |
| $\theta_{i,g}$               | 1.441 9 |
| $\theta'_{C,t}$              | 0.771 1 |
| $\theta'_{e,C'}$             | 0.478 6 |
| $\theta'_{F,e}$              | 0.521 4 |
| $\theta'_{i,F'}$             | 1.939 5 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.010 2 |
| $\Delta\theta_{C,A'}$ | 0.002 2 |
| $\Delta\theta_{g,d}$  | 0.003 4 |
| $\Delta\theta_{g,F}$  | 0.003 6 |
| $\Delta\theta_{i,g}$  | 0.035 3 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 385  | $\lambda_5$      | 350 |
| $\lambda_{70}$        |      |                  |     |
|                       |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 378  | $\lambda_{0.05}$ | 357 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.79 | 0.81             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.19             |
| 370                    | 0.60             |
| 380                    | 0.84             |
| 390                    | 0.931            |
| 400                    | 0.963            |
| 420                    | 0.984            |
| 440                    | 0.989            |
| 460                    | 0.991            |
| 480                    | 0.993            |
| 500                    | 0.995            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.997            |
| 700                    | 0.997            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.994            |
| 1 600                  | 0.994            |
| 1 800                  | 0.982            |
| 2 000                  | 0.966            |
| 2 200                  | 0.923            |
| 2 400                  | 0.902            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 535  |
| Annealing Point AP (°C)                                          | 565  |
| Transformation Temperature Tg (°C)                               | 596  |
| Yield Point At (°C)                                              | 632  |
| Softening Point SP (°C)                                          | 700  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 82   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 100  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.04 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 65                                             |
| -90 ~ -80                               | 67                                             |
| -80 ~ -70                               | 68                                             |
| -70 ~ -60                               | 70                                             |
| -60 ~ -50                               | 72                                             |
| -50 ~ -40                               | 73                                             |
| -40 ~ -30                               | 75                                             |
| -30 ~ -20                               | 77                                             |
| -20 ~ -10                               | 78                                             |
| -10 ~ 0                                 | 80                                             |
| 0 ~ 10                                  | 81                                             |
| 10 ~ 20                                 | 82                                             |
| 20 ~ 30                                 | 84                                             |
| 30 ~ 40                                 | 85                                             |
| 40 ~ 50                                 | 86                                             |
| 50 ~ 60                                 | 88                                             |
| 60 ~ 70                                 | 89                                             |
| 70 ~ 80                                 | 90                                             |
| 80 ~ 90                                 | 91                                             |
| 90 ~ 100                                | 92                                             |
| 100 ~ 110                               | 93                                             |
| 110 ~ 120                               | 94                                             |
| 120 ~ 130                               | 95                                             |
| 130 ~ 140                               | 96                                             |
| 140 ~ 150                               | 97                                             |
| 150 ~ 160                               | 97                                             |
| 160 ~ 170                               | 98                                             |
| 170 ~ 180                               | 99                                             |
| 180 ~ 190                               | 100                                            |
| 190 ~ 200                               | 100                                            |
| 200 ~ 210                               | 101                                            |
| 210 ~ 220                               | 101                                            |
| 220 ~ 230                               | 102                                            |
| 230 ~ 240                               | 102                                            |
| 240 ~ 250                               | 103                                            |
| 250 ~ 260                               | 103                                            |
| 260 ~ 270                               | 103                                            |
| 270 ~ 280                               | 104                                            |
| 280 ~ 290                               | 104                                            |
| 290 ~ 300                               | 104                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.84 |
| Specific Gravity $d$                                      | 2.63 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 1.0                                                             | 1.2 | 1.5 | 1.6 | 1.7 | 1.9 | 2.1 | 2.6 | 2.7 | 3.3 | 3.9 | 5.6 |
| -60 ~ -40                                    | 0.8                                                             | 1.0 | 1.4 | 1.5 | 1.6 | 1.8 | 2.0 | 2.4 | 2.5 | 3.2 | 3.9 | 5.6 |
| -40 ~ -20                                    | 0.8                                                             | 0.9 | 1.4 | 1.5 | 1.5 | 1.7 | 2.0 | 2.4 | 2.5 | 3.1 | 4.0 | 5.7 |
| -20 ~ 0                                      | 0.8                                                             | 0.9 | 1.3 | 1.4 | 1.5 | 1.8 | 2.0 | 2.5 | 2.6 | 3.2 | 4.0 | 5.9 |
| 0 ~ 20                                       | 0.8                                                             | 1.0 | 1.4 | 1.5 | 1.6 | 1.8 | 2.0 | 2.6 | 2.6 | 3.4 | 4.2 | 6.1 |
| 20 ~ 40                                      | 0.9                                                             | 1.0 | 1.5 | 1.6 | 1.6 | 1.9 | 2.1 | 2.7 | 2.7 | 3.5 | 4.4 | 6.3 |
| 40 ~ 60                                      | 0.9                                                             | 1.1 | 1.5 | 1.6 | 1.7 | 1.9 | 2.2 | 2.8 | 2.8 | 3.7 | 4.6 | 6.5 |
| 60 ~ 80                                      | 1.0                                                             | 1.2 | 1.6 | 1.8 | 1.8 | 2.1 | 2.3 | 2.9 | 3.0 | 3.8 | 4.7 | 6.9 |
| 80 ~ 100                                     | 0.9                                                             | 1.3 | 1.7 | 1.9 | 1.9 | 2.2 | 2.5 | 3.1 | 3.1 | 4.0 | 4.9 | 7.0 |
| 100 ~ 120                                    | 1.0                                                             | 1.3 | 1.8 | 1.9 | 2.0 | 2.3 | 2.5 | 3.2 | 3.3 | 4.1 | 5.0 | 7.2 |
| 120 ~ 140                                    | 1.1                                                             | 1.3 | 1.8 | 2.0 | 2.0 | 2.3 | 2.6 | 3.3 | 3.4 | 4.2 | 5.2 | 7.5 |
| 140 ~ 160                                    | 1.1                                                             | 1.3 | 1.8 | 2.0 | 2.1 | 2.3 | 2.6 | 3.3 | 3.4 | 4.3 | 5.3 | 7.7 |
| 160 ~ 180                                    | 1.1                                                             | 1.3 | 1.8 | 2.1 | 2.2 | 2.5 | 2.8 | 3.4 | 3.5 | 4.5 | 5.5 | 7.9 |

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## S-TIM 8

Code(d) **596392**  
Code(e) **599390**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.595 51</b><br>1.595 509 | Abbe Number $\nu_d$ | <b>39.24</b> | Dispersion $n_F - n_C$       | <b>0.015 176</b> |
| Refractive Index $n_e$ | 1.599 106                    | Abbe Number $\nu_e$ | 38.97        | Dispersion $n_{F'} - n_{C'}$ | 0.015 375        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.560 75 |
| $n_{1970}$         | 1.970 09  | 1.566 15 |
| $n_{1530}$         | 1.529 58  | 1.572 12 |
| $n_{1129}$         | 1.128 64  | 1.577 78 |
| $n_t$              | 1.013 98  | 1.579 80 |
| $n_s$              | 0.852 11  | 1.583 47 |
| $n_{A'}$           | 0.768 19  | 1.586 09 |
| $n_F$              | 0.706 52  | 1.588 54 |
| $n_C$              | 0.656 27  | 1.591 03 |
| $n_{C'}$           | 0.643 85  | 1.591 73 |
| $n_{He-Ne}$        | 0.632 8   | 1.592 40 |
| $n_D$              | 0.589 29  | 1.595 38 |
| $n_d$              | 0.587 56  | 1.595 51 |
| $n_e$              | 0.546 07  | 1.599 11 |
| $n_F$              | 0.486 13  | 1.606 21 |
| $n_{F'}$           | 0.479 99  | 1.607 11 |
| $n_{He-Cd}$        | 0.441 57  | 1.613 82 |
| $n_g$              | 0.435 835 | 1.615 01 |
| $n_h$              | 0.404 656 | 1.622 67 |
| $n_i$              | 0.365 015 | 1.636 61 |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.372 627 13E+00 |
| $A_2$                           | 1.126 362 76E-01 |
| $A_3$                           | 1.397 864 21E+00 |
| $B_1$                           | 1.032 200 68E-02 |
| $B_2$                           | 5.501 950 44E-02 |
| $B_3$                           | 1.477 356 09E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2~3 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 75.0  |
| Rigidity Modulus G (GPa) | 30.5  |
| Poisson's Ratio $\sigma$ | 0.231 |
| Knoop Hardness Hk[Class] | 530   |
| Abrasion Aa              | 135   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.011 234 |
| $n_C - n_{A'}$      | 0.004 942 |
| $n_d - n_C$         | 0.004 479 |
| $n_e - n_C$         | 0.008 076 |
| $n_g - n_d$         | 0.019 504 |
| $n_g - n_F$         | 0.008 807 |
| $n_h - n_g$         | 0.007 657 |
| $n_i - n_g$         | 0.021 600 |
| $n_{C'} - n_t$      | 0.011 938 |
| $n_e - n_{C'}$      | 0.007 372 |
| $n_{F'} - n_e$      | 0.008 003 |
| $n_i - n_{F'}$      | 0.029 504 |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.740 2 |
| $\theta_{C,A'}$              | 0.325 6 |
| $\theta_{d,C}$               | 0.295 1 |
| $\theta_{e,C}$               | 0.532 2 |
| $\theta_{g,d}$               | 1.285 2 |
| $\theta_{g,F}$               | 0.580 3 |
| $\theta_{h,g}$               | 0.504 5 |
| $\theta_{i,g}$               | 1.423 3 |
| $\theta'_{C,t}$              | 0.776 5 |
| $\theta'_{e,C'}$             | 0.479 5 |
| $\theta'_{F,e}$              | 0.520 5 |
| $\theta'_{i,F'}$             | 1.919 0 |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.009 4 |
| $\Delta\theta_{C,A'}$ | 0.002 2 |
| $\Delta\theta_{g,d}$  | 0.002 0 |
| $\Delta\theta_{g,F}$  | 0.002 3 |
| $\Delta\theta_{i,g}$  | 0.026 9 |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 380  | $\lambda_5$      | 350 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 378  | $\lambda_{0.05}$ | 351 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 0.82 | 0.82             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    | 0.02             |
| 360                    | 0.27             |
| 370                    | 0.64             |
| 380                    | 0.84             |
| 390                    | 0.928            |
| 400                    | 0.962            |
| 420                    | 0.982            |
| 440                    | 0.988            |
| 460                    | 0.990            |
| 480                    | 0.992            |
| 500                    | 0.994            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.998            |
| 900                    | 0.997            |
| 1 000                  | 0.996            |
| 1 200                  | 0.996            |
| 1 400                  | 0.994            |
| 1 600                  | 0.993            |
| 1 800                  | 0.983            |
| 2 000                  | 0.968            |
| 2 200                  | 0.935            |
| 2 400                  | 0.915            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 529  |
| Annealing Point AP (°C)                                          | 560  |
| Transformation Temperature Tg (°C)                               | 582  |
| Yield Point At (°C)                                              | 627  |
| Softening Point SP (°C)                                          | 695  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 86   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 105  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.03 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 68                                             |
| -90 ~ -80                               | 70                                             |
| -80 ~ -70                               | 72                                             |
| -70 ~ -60                               | 74                                             |
| -60 ~ -50                               | 75                                             |
| -50 ~ -40                               | 77                                             |
| -40 ~ -30                               | 79                                             |
| -30 ~ -20                               | 80                                             |
| -20 ~ -10                               | 82                                             |
| -10 ~ 0                                 | 84                                             |
| 0 ~ 10                                  | 85                                             |
| 10 ~ 20                                 | 86                                             |
| 20 ~ 30                                 | 88                                             |
| 30 ~ 40                                 | 89                                             |
| 40 ~ 50                                 | 91                                             |
| 50 ~ 60                                 | 92                                             |
| 60 ~ 70                                 | 93                                             |
| 70 ~ 80                                 | 94                                             |
| 80 ~ 90                                 | 95                                             |
| 90 ~ 100                                | 97                                             |
| 100 ~ 110                               | 98                                             |
| 110 ~ 120                               | 99                                             |
| 120 ~ 130                               | 100                                            |
| 130 ~ 140                               | 101                                            |
| 140 ~ 150                               | 101                                            |
| 150 ~ 160                               | 102                                            |
| 160 ~ 170                               | 103                                            |
| 170 ~ 180                               | 104                                            |
| 180 ~ 190                               | 105                                            |
| 190 ~ 200                               | 105                                            |
| 200 ~ 210                               | 106                                            |
| 210 ~ 220                               | 107                                            |
| 220 ~ 230                               | 107                                            |
| 230 ~ 240                               | 108                                            |
| 240 ~ 250                               | 108                                            |
| 250 ~ 260                               | 108                                            |
| 260 ~ 270                               | 109                                            |
| 270 ~ 280                               | 109                                            |
| 280 ~ 290                               | 110                                            |
| 290 ~ 300                               | 110                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.79 |
| Specific Gravity $d$                                     | 2.63 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |     |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i   |
| -80 ~ -60                                    | 0.8                                                             | 1.0 | 1.3 | 1.4 | 1.4 | 1.6 | 1.8 | 2.2 | 2.3 | 2.8 | 3.3 | 4.6 |
| -60 ~ -40                                    | 0.7                                                             | 0.8 | 1.1 | 1.3 | 1.3 | 1.5 | 1.7 | 2.0 | 2.1 | 2.6 | 3.3 | 4.6 |
| -40 ~ -20                                    | 0.5                                                             | 0.7 | 1.0 | 1.1 | 1.2 | 1.4 | 1.6 | 2.0 | 2.1 | 2.7 | 3.3 | 4.8 |
| -20 ~ 0                                      | 0.5                                                             | 0.6 | 1.0 | 1.1 | 1.1 | 1.4 | 1.6 | 2.1 | 2.2 | 2.8 | 3.4 | 5.1 |
| 0 ~ 20                                       | 0.4                                                             | 0.7 | 1.0 | 1.1 | 1.2 | 1.4 | 1.6 | 2.1 | 2.2 | 2.8 | 3.6 | 5.3 |
| 20 ~ 40                                      | 0.5                                                             | 0.6 | 1.0 | 1.2 | 1.2 | 1.5 | 1.7 | 2.2 | 2.3 | 3.0 | 3.7 | 5.6 |
| 40 ~ 60                                      | 0.4                                                             | 0.6 | 1.0 | 1.2 | 1.2 | 1.5 | 1.7 | 2.3 | 2.4 | 3.2 | 4.0 | 5.8 |
| 60 ~ 80                                      | 0.5                                                             | 0.7 | 1.1 | 1.3 | 1.3 | 1.6 | 1.8 | 2.4 | 2.5 | 3.3 | 4.1 | 6.1 |
| 80 ~ 100                                     | 0.4                                                             | 0.6 | 1.2 | 1.3 | 1.4 | 1.6 | 1.9 | 2.5 | 2.6 | 3.4 | 4.3 | 6.4 |
| 100 ~ 120                                    | 0.4                                                             | 0.7 | 1.2 | 1.3 | 1.4 | 1.7 | 2.0 | 2.6 | 2.7 | 3.6 | 4.5 | 6.7 |
| 120 ~ 140                                    | 0.4                                                             | 0.6 | 1.2 | 1.3 | 1.4 | 1.7 | 2.0 | 2.7 | 2.8 | 3.7 | 4.7 | 6.9 |
| 140 ~ 160                                    | 0.3                                                             | 0.6 | 1.1 | 1.3 | 1.4 | 1.7 | 2.0 | 2.7 | 2.8 | 3.7 | 4.8 | 7.2 |
| 160 ~ 180                                    | 0.2                                                             | 0.5 | 1.1 | 1.3 | 1.4 | 1.7 | 2.1 | 2.8 | 2.9 | 3.9 | 5.0 | 7.4 |

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## S-TIM25

Code(d) 673321

Code(e) 678318

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.672 70<br>1.672 700 | Abbe Number $\nu_d$ | 32.10 | Dispersion $n_F - n_C$       | 0.020 957 |
| Refractive Index $n_e$ | 1.677 651             | Abbe Number $\nu_e$ | 31.84 | Dispersion $n_{F'} - n_{C'}$ | 0.021 280 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.629 88 |
| $n_{1970}$         | 1.970 09  | 1.635 83 |
| $n_{1530}$         | 1.529 58  | 1.642 58 |
| $n_{1129}$         | 1.128 64  | 1.649 33 |
| $n_t$              | 1.013 98  | 1.651 84 |
| $n_s$              | 0.852 11  | 1.656 56 |
| $n_{A'}$           | 0.768 19  | 1.660 00 |
| $n_F$              | 0.706 52  | 1.663 26 |
| $n_C$              | 0.656 27  | 1.666 61 |
| $n_{C'}$           | 0.643 85  | 1.667 56 |
| $n_{He-Ne}$        | 0.632 8   | 1.668 46 |
| $n_D$              | 0.589 29  | 1.672 52 |
| $n_d$              | 0.587 56  | 1.672 70 |
| $n_e$              | 0.546 07  | 1.677 65 |
| $n_F$              | 0.486 13  | 1.687 56 |
| $n_{F'}$           | 0.479 99  | 1.688 84 |
| $n_{He-Cd}$        | 0.441 57  | 1.698 40 |
| $n_g$              | 0.435 835 | 1.700 11 |
| $n_h$              | 0.404 656 | 1.711 26 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.506 592 33E+00 |
| $A_2$                           | 2.047 861 35E-01 |
| $A_3$                           | 1.920 366 68E+00 |
| $B_1$                           | 1.095 015 62E-02 |
| $B_2$                           | 5.749 802 85E-02 |
| $B_3$                           | 1.781 285 35E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.2 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 84.1  |
| Rigidity Modulus G (GPa) | 34.0  |
| Poisson's Ratio $\sigma$ | 0.236 |
| Knoop Hardness Hk[Class] | 570 6 |
| Abrasion Aa              | 146   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.014 766 |
| $n_C - n_{A'}$      | 0.006 611 |
| $n_d - n_C$         | 0.006 093 |
| $n_e - n_C$         | 0.011 044 |
| $n_g - n_d$         | 0.027 414 |
| $n_g - n_F$         | 0.012 550 |
| $n_h - n_g$         | 0.011 144 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.015 718 |
| $n_e - n_{C'}$      | 0.010 092 |
| $n_{F'} - n_e$      | 0.011 188 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.704 6 |
| $\theta_{C,A'}$              | 0.315 5 |
| $\theta_{d,C}$               | 0.290 7 |
| $\theta_{e,C}$               | 0.527 0 |
| $\theta_{g,d}$               | 1.308 1 |
| $\theta_{g,F}$               | 0.598 8 |
| $\theta_{h,g}$               | 0.531 8 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.738 6 |
| $\theta'_{e,C'}$             | 0.474 2 |
| $\theta'_{F,e}$              | 0.525 8 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.007 3 |
| $\Delta\theta_{C,A'}$ | 0.000 7 |
| $\Delta\theta_{g,d}$  | 0.010 1 |
| $\Delta\theta_{g,F}$  | 0.009 3 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 400  | $\lambda_5$      | 360 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 390  | $\lambda_{0.05}$ | 362 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.11 | 2.17             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.01             |
| 370                    | 0.24             |
| 380                    | 0.60             |
| 390                    | 0.80             |
| 400                    | 0.89             |
| 420                    | 0.957            |
| 440                    | 0.974            |
| 460                    | 0.981            |
| 480                    | 0.986            |
| 500                    | 0.989            |
| 550                    | 0.995            |
| 600                    | 0.996            |
| 650                    | 0.995            |
| 700                    | 0.996            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.995            |
| 1 600                  | 0.995            |
| 1 800                  | 0.987            |
| 2 000                  | 0.977            |
| 2 200                  | 0.944            |
| 2 400                  | 0.930            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 556  |
| Annealing Point AP (°C)                                          | 585  |
| Transformation Temperature Tg (°C)                               | 613  |
| Yield Point At (°C)                                              | 649  |
| Softening Point SP (°C)                                          | 700  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 82   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 98   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.05 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 69                                             |
| -90 ~ -80                               | 70                                             |
| -80 ~ -70                               | 71                                             |
| -70 ~ -60                               | 72                                             |
| -60 ~ -50                               | 73                                             |
| -50 ~ -40                               | 75                                             |
| -40 ~ -30                               | 76                                             |
| -30 ~ -20                               | 77                                             |
| -20 ~ -10                               | 78                                             |
| -10 ~ 0                                 | 79                                             |
| 0 ~ 10                                  | 80                                             |
| 10 ~ 20                                 | 81                                             |
| 20 ~ 30                                 | 82                                             |
| 30 ~ 40                                 | 83                                             |
| 40 ~ 50                                 | 84                                             |
| 50 ~ 60                                 | 85                                             |
| 60 ~ 70                                 | 86                                             |
| 70 ~ 80                                 | 87                                             |
| 80 ~ 90                                 | 88                                             |
| 90 ~ 100                                | 89                                             |
| 100 ~ 110                               | 90                                             |
| 110 ~ 120                               | 91                                             |
| 120 ~ 130                               | 92                                             |
| 130 ~ 140                               | 93                                             |
| 140 ~ 150                               | 94                                             |
| 150 ~ 160                               | 94                                             |
| 160 ~ 170                               | 95                                             |
| 170 ~ 180                               | 96                                             |
| 180 ~ 190                               | 97                                             |
| 190 ~ 200                               | 98                                             |
| 200 ~ 210                               | 99                                             |
| 210 ~ 220                               | 99                                             |
| 220 ~ 230                               | 100                                            |
| 230 ~ 240                               | 101                                            |
| 240 ~ 250                               | 102                                            |
| 250 ~ 260                               | 102                                            |
| 260 ~ 270                               | 103                                            |
| 270 ~ 280                               | 104                                            |
| 280 ~ 290                               | 104                                            |
| 290 ~ 300                               | 105                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.81 |
| Specific Gravity $d$                                     | 2.91 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | 0.6                                                             | 0.8 | 1.3 | 1.4 | 1.5 | 1.8 | 2.1 | 2.8 | 2.9 | 3.8 | 4.9 | - |
| -60 ~ -40                                    | 0.5                                                             | 0.7 | 1.3 | 1.5 | 1.5 | 1.8 | 2.1 | 2.8 | 2.9 | 3.9 | 5.0 | - |
| -40 ~ -20                                    | 0.6                                                             | 0.8 | 1.3 | 1.6 | 1.6 | 1.9 | 2.3 | 3.0 | 3.1 | 4.1 | 5.3 | - |
| -20 ~ 0                                      | 0.7                                                             | 0.9 | 1.5 | 1.6 | 1.7 | 2.0 | 2.4 | 3.2 | 3.3 | 4.3 | 5.5 | - |
| 0 ~ 20                                       | 0.8                                                             | 1.0 | 1.7 | 1.9 | 1.9 | 2.3 | 2.6 | 3.4 | 3.5 | 4.5 | 5.8 | - |
| 20 ~ 40                                      | 0.9                                                             | 1.2 | 1.7 | 2.0 | 2.1 | 2.5 | 2.8 | 3.6 | 3.7 | 4.8 | 6.1 | - |
| 40 ~ 60                                      | 1.0                                                             | 1.4 | 2.0 | 2.2 | 2.3 | 2.6 | 3.0 | 3.8 | 3.9 | 5.1 | 6.4 | - |
| 60 ~ 80                                      | 1.2                                                             | 1.5 | 2.1 | 2.3 | 2.4 | 2.7 | 3.2 | 4.1 | 4.2 | 5.4 | 6.8 | - |
| 80 ~ 100                                     | 1.3                                                             | 1.6 | 2.2 | 2.5 | 2.5 | 2.9 | 3.3 | 4.2 | 4.3 | 5.6 | 7.1 | - |
| 100 ~ 120                                    | 1.4                                                             | 1.7 | 2.3 | 2.6 | 2.6 | 3.0 | 3.4 | 4.4 | 4.5 | 5.8 | 7.2 | - |
| 120 ~ 140                                    | 1.4                                                             | 1.7 | 2.4 | 2.7 | 2.7 | 3.1 | 3.6 | 4.5 | 4.6 | 6.0 | 7.6 | - |
| 140 ~ 160                                    | 1.4                                                             | 1.7 | 2.4 | 2.7 | 2.8 | 3.2 | 3.7 | 4.7 | 4.8 | 6.2 | 7.7 | - |
| 160 ~ 180                                    | 1.5                                                             | 1.8 | 2.5 | 2.8 | 2.9 | 3.3 | 3.7 | 4.7 | 4.9 | 6.3 | 7.9 | - |

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## S-TIM27

Code(d) 640345

Code(e) 644342

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.639 80<br>1.639 799 | Abbe Number $\nu_d$ | 34.46 | Dispersion $n_F - n_C$       | 0.018 564 |
| Refractive Index $n_e$ | 1.644 189             | Abbe Number $\nu_e$ | 34.20 | Dispersion $n_{F'} - n_{C'}$ | 0.018 835 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.600 36 |
| $n_{1970}$         | 1.970 09  | 1.606 08 |
| $n_{1530}$         | 1.529 58  | 1.612 49 |
| $n_{1129}$         | 1.128 64  | 1.618 78 |
| $n_t$              | 1.013 98  | 1.621 08 |
| $n_s$              | 0.852 11  | 1.625 37 |
| $n_{A'}$           | 0.768 19  | 1.628 46 |
| $n_F$              | 0.706 52  | 1.631 38 |
| $n_C$              | 0.656 27  | 1.634 38 |
| $n_{C'}$           | 0.643 85  | 1.635 22 |
| $n_{He-Ne}$        | 0.632 8   | 1.636 02 |
| $n_D$              | 0.589 29  | 1.639 64 |
| $n_d$              | 0.587 56  | 1.639 80 |
| $n_e$              | 0.546 07  | 1.644 19 |
| $n_F$              | 0.486 13  | 1.652 94 |
| $n_{F'}$           | 0.479 99  | 1.654 06 |
| $n_{He-Cd}$        | 0.441 57  | 1.662 44 |
| $n_g$              | 0.435 835 | 1.663 93 |
| $n_h$              | 0.404 656 | 1.673 61 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.416 804 70E+00 |
| $A_2$                           | 1.967 850 57E-01 |
| $A_3$                           | 1.680 013 22E+00 |
| $B_1$                           | 1.007 321 58E-02 |
| $B_2$                           | 5.376 169 08E-02 |
| $B_3$                           | 1.646 724 36E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 2   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 79.3  |
| Rigidity Modulus G (GPa) | 32.1  |
| Poisson's Ratio $\sigma$ | 0.236 |
| Knoop Hardness Hk[Class] | 560 6 |
| Abrasion Aa              | 146   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.013 292 |
| $n_C - n_{A'}$      | 0.005 916 |
| $n_d - n_C$         | 0.005 424 |
| $n_e - n_C$         | 0.009 814 |
| $n_g - n_d$         | 0.024 134 |
| $n_g - n_F$         | 0.010 994 |
| $n_h - n_g$         | 0.009 680 |
| $n_i - n_g$         |           |
| $n_C - n_t$         | 0.014 141 |
| $n_e - n_{C'}$      | 0.008 965 |
| $n_{F'} - n_e$      | 0.009 870 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.716 0 |
| $\theta_{C,A'}$              | 0.318 7 |
| $\theta_{d,C}$               | 0.292 2 |
| $\theta_{e,C}$               | 0.528 7 |
| $\theta_{g,d}$               | 1.300 0 |
| $\theta_{g,F}$               | 0.592 2 |
| $\theta_{h,g}$               | 0.521 4 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.750 8 |
| $\theta'_{e,C'}$             | 0.476 0 |
| $\theta'_{F',e}$             | 0.524 0 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.007 6 |
| $\Delta\theta_{C,A'}$ | 0.001 1 |
| $\Delta\theta_{g,d}$  | 0.006 9 |
| $\Delta\theta_{g,F}$  | 0.006 5 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 390  | $\lambda_5$      | 360 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 385  | $\lambda_{0.05}$ | 360 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 1.37 | 1.38             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.05             |
| 370                    | 0.41             |
| 380                    | 0.73             |
| 390                    | 0.87             |
| 400                    | 0.935            |
| 420                    | 0.973            |
| 440                    | 0.983            |
| 460                    | 0.987            |
| 480                    | 0.990            |
| 500                    | 0.992            |
| 550                    | 0.997            |
| 600                    | 0.997            |
| 650                    | 0.996            |
| 700                    | 0.997            |
| 800                    | 0.999            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.995            |
| 1 600                  | 0.994            |
| 1 800                  | 0.984            |
| 2 000                  | 0.973            |
| 2 200                  | 0.936            |
| 2 400                  | 0.919            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 543  |
| Annealing Point AP (°C)                                          | 572  |
| Transformation Temperature Tg (°C)                               | 598  |
| Yield Point At (°C)                                              | 638  |
| Softening Point SP (°C)                                          | 696  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 85   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 102  |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.04 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_l$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 68                                             |
| -90 ~ -80                               | 70                                             |
| -80 ~ -70                               | 72                                             |
| -70 ~ -60                               | 74                                             |
| -60 ~ -50                               | 75                                             |
| -50 ~ -40                               | 77                                             |
| -40 ~ -30                               | 78                                             |
| -30 ~ -20                               | 80                                             |
| -20 ~ -10                               | 81                                             |
| -10 ~ 0                                 | 83                                             |
| 0 ~ 10                                  | 84                                             |
| 10 ~ 20                                 | 85                                             |
| 20 ~ 30                                 | 87                                             |
| 30 ~ 40                                 | 88                                             |
| 40 ~ 50                                 | 89                                             |
| 50 ~ 60                                 | 90                                             |
| 60 ~ 70                                 | 91                                             |
| 70 ~ 80                                 | 92                                             |
| 80 ~ 90                                 | 93                                             |
| 90 ~ 100                                | 94                                             |
| 100 ~ 110                               | 95                                             |
| 110 ~ 120                               | 96                                             |
| 120 ~ 130                               | 97                                             |
| 130 ~ 140                               | 98                                             |
| 140 ~ 150                               | 99                                             |
| 150 ~ 160                               | 100                                            |
| 160 ~ 170                               | 100                                            |
| 170 ~ 180                               | 101                                            |
| 180 ~ 190                               | 102                                            |
| 190 ~ 200                               | 102                                            |
| 200 ~ 210                               | 103                                            |
| 210 ~ 220                               | 103                                            |
| 220 ~ 230                               | 104                                            |
| 230 ~ 240                               | 104                                            |
| 240 ~ 250                               | 104                                            |
| 250 ~ 260                               | 105                                            |
| 260 ~ 270                               | 105                                            |
| 270 ~ 280                               | 105                                            |
| 280 ~ 290                               | 106                                            |
| 290 ~ 300                               | 106                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 2.83 |
| Specific Gravity $d$                                      | 2.76 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | 0.6                                                             | 0.8 | 1.2 | 1.4 | 1.4 | 1.6 | 1.8 | 2.3 | 2.5 | 3.2 | 4.0 | - |
| -60 ~ -40                                    | 0.6                                                             | 0.7 | 1.1 | 1.2 | 1.3 | 1.5 | 1.8 | 2.4 | 2.5 | 3.2 | 4.1 | - |
| -40 ~ -20                                    | 0.5                                                             | 0.7 | 1.1 | 1.2 | 1.3 | 1.5 | 1.8 | 2.5 | 2.6 | 3.4 | 4.3 | - |
| -20 ~ 0                                      | 0.5                                                             | 0.8 | 1.2 | 1.3 | 1.4 | 1.7 | 1.9 | 2.5 | 2.6 | 3.6 | 4.6 | - |
| 0 ~ 20                                       | 0.6                                                             | 0.8 | 1.2 | 1.4 | 1.4 | 1.7 | 2.0 | 2.8 | 2.9 | 3.8 | 4.8 | - |
| 20 ~ 40                                      | 0.6                                                             | 0.8 | 1.3 | 1.5 | 1.6 | 1.9 | 2.2 | 3.0 | 3.1 | 4.0 | 5.1 | - |
| 40 ~ 60                                      | 0.7                                                             | 0.9 | 1.4 | 1.7 | 1.8 | 2.1 | 2.4 | 3.1 | 3.2 | 4.2 | 5.4 | - |
| 60 ~ 80                                      | 0.8                                                             | 1.0 | 1.6 | 1.8 | 1.8 | 2.1 | 2.5 | 3.3 | 3.4 | 4.4 | 5.7 | - |
| 80 ~ 100                                     | 0.8                                                             | 1.1 | 1.7 | 1.9 | 1.9 | 2.3 | 2.6 | 3.4 | 3.6 | 4.7 | 5.9 | - |
| 100 ~ 120                                    | 0.9                                                             | 1.2 | 1.8 | 2.0 | 2.0 | 2.4 | 2.8 | 3.6 | 3.7 | 4.9 | 6.2 | - |
| 120 ~ 140                                    | 0.9                                                             | 1.2 | 1.8 | 2.0 | 2.1 | 2.5 | 2.9 | 3.7 | 3.9 | 5.1 | 6.4 | - |
| 140 ~ 160                                    | 0.8                                                             | 1.2 | 1.8 | 2.0 | 2.1 | 2.5 | 2.9 | 3.9 | 3.9 | 5.3 | 6.7 | - |
| 160 ~ 180                                    | 0.9                                                             | 1.2 | 1.9 | 2.1 | 2.2 | 2.6 | 3.0 | 4.0 | 4.1 | 5.4 | 6.9 | - |

OHARA 25-04

## S-TIM28

Code(d) **689311**  
Code(e) **694308**

|                        |                              |                     |              |                              |                  |
|------------------------|------------------------------|---------------------|--------------|------------------------------|------------------|
| Refractive Index $n_d$ | <b>1.688 93</b><br>1.688 931 | Abbe Number $\nu_d$ | <b>31.07</b> | Dispersion $n_F - n_C$       | <b>0.022 170</b> |
| Refractive Index $n_e$ | 1.694 167                    | Abbe Number $\nu_e$ | 30.83        | Dispersion $n_{F'} - n_{C'}$ | 0.022 516        |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.644 63 |
| $n_{1970}$         | 1.970 09  | 1.650 62 |
| $n_{1530}$         | 1.529 58  | 1.657 45 |
| $n_{1129}$         | 1.128 64  | 1.664 38 |
| $n_t$              | 1.013 98  | 1.666 99 |
| $n_s$              | 0.852 11  | 1.671 92 |
| $n_{A'}$           | 0.768 19  | 1.675 53 |
| $n_F$              | 0.706 52  | 1.678 96 |
| $n_C$              | 0.656 27  | 1.682 50 |
| $n_{C'}$           | 0.643 85  | 1.683 50 |
| $n_{\text{He-Ne}}$ | 0.632 8   | 1.684 45 |
| $n_D$              | 0.589 29  | 1.688 74 |
| $n_d$              | 0.587 56  | 1.688 93 |
| $n_e$              | 0.546 07  | 1.694 17 |
| $n_F$              | 0.486 13  | 1.704 67 |
| $n_{F'}$           | 0.479 99  | 1.706 02 |
| $n_{\text{He-Cd}}$ | 0.441 57  | 1.716 15 |
| $n_g$              | 0.435 835 | 1.717 97 |
| $n_h$              | 0.404 656 | 1.729 81 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.542 708 10E+00 |
| $A_2$                           | 2.171 138 91E-01 |
| $A_3$                           | 1.819 044 59E+00 |
| $B_1$                           | 1.139 250 05E-02 |
| $B_2$                           | 5.792 245 72E-02 |
| $B_3$                           | 1.676 971 89E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1   |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 85.5  |
| Rigidity Modulus G (GPa) | 34.4  |
| Poisson's Ratio $\sigma$ | 0.242 |
| Knoop Hardness Hk[Class] | 560   |
| Abrasion Aa              | 152   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.015 507 |
| $n_C - n_{A'}$      | 0.006 966 |
| $n_d - n_C$         | 0.006 436 |
| $n_e - n_C$         | 0.011 672 |
| $n_g - n_d$         | 0.029 044 |
| $n_g - n_F$         | 0.013 310 |
| $n_h - n_g$         | 0.011 834 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.016 512 |
| $n_e - n_{C'}$      | 0.010 667 |
| $n_{F'} - n_e$      | 0.011 849 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.699 5 |
| $\theta_{C,A'}$              | 0.314 2 |
| $\theta_{d,C}$               | 0.290 3 |
| $\theta_{e,C}$               | 0.526 5 |
| $\theta_{g,d}$               | 1.310 1 |
| $\theta_{g,F}$               | 0.600 4 |
| $\theta_{h,g}$               | 0.533 8 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.733 3 |
| $\theta'_{e,C'}$             | 0.473 8 |
| $\theta'_{F,e}$              | 0.526 2 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.007 1 |
| $\Delta\theta_{C,A'}$ | 0.000 7 |
| $\Delta\theta_{g,d}$  | 0.009 9 |
| $\Delta\theta_{g,F}$  | 0.009 2 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 405  | $\lambda_5$      | 360 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 391  | $\lambda_{0.05}$ | 362 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.30 | 2.36             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    | 0.01             |
| 370                    | 0.23             |
| 380                    | 0.58             |
| 390                    | 0.79             |
| 400                    | 0.88             |
| 420                    | 0.951            |
| 440                    | 0.970            |
| 460                    | 0.978            |
| 480                    | 0.983            |
| 500                    | 0.987            |
| 550                    | 0.994            |
| 600                    | 0.995            |
| 650                    | 0.994            |
| 700                    | 0.995            |
| 800                    | 0.998            |
| 900                    | 0.998            |
| 1 000                  | 0.998            |
| 1 200                  | 0.998            |
| 1 400                  | 0.996            |
| 1 600                  | 0.996            |
| 1 800                  | 0.989            |
| 2 000                  | 0.983            |
| 2 200                  | 0.961            |
| 2 400                  | 0.948            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 560  |
| Annealing Point AP (°C)                                          | 588  |
| Transformation Temperature Tg (°C)                               | 615  |
| Yield Point At (°C)                                              | 655  |
| Softening Point SP (°C)                                          | 701  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 81   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 99   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.01 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 66                                             |
| -90 ~ -80                               | 68                                             |
| -80 ~ -70                               | 69                                             |
| -70 ~ -60                               | 70                                             |
| -60 ~ -50                               | 72                                             |
| -50 ~ -40                               | 73                                             |
| -40 ~ -30                               | 74                                             |
| -30 ~ -20                               | 76                                             |
| -20 ~ -10                               | 77                                             |
| -10 ~ 0                                 | 78                                             |
| 0 ~ 10                                  | 79                                             |
| 10 ~ 20                                 | 81                                             |
| 20 ~ 30                                 | 82                                             |
| 30 ~ 40                                 | 83                                             |
| 40 ~ 50                                 | 84                                             |
| 50 ~ 60                                 | 85                                             |
| 60 ~ 70                                 | 86                                             |
| 70 ~ 80                                 | 87                                             |
| 80 ~ 90                                 | 88                                             |
| 90 ~ 100                                | 89                                             |
| 100 ~ 110                               | 90                                             |
| 110 ~ 120                               | 91                                             |
| 120 ~ 130                               | 92                                             |
| 130 ~ 140                               | 93                                             |
| 140 ~ 150                               | 94                                             |
| 150 ~ 160                               | 95                                             |
| 160 ~ 170                               | 96                                             |
| 170 ~ 180                               | 97                                             |
| 180 ~ 190                               | 98                                             |
| 190 ~ 200                               | 99                                             |
| 200 ~ 210                               | 99                                             |
| 210 ~ 220                               | 100                                            |
| 220 ~ 230                               | 101                                            |
| 230 ~ 240                               | 102                                            |
| 240 ~ 250                               | 102                                            |
| 250 ~ 260                               | 103                                            |
| 260 ~ 270                               | 104                                            |
| 270 ~ 280                               | 104                                            |
| 280 ~ 290                               | 105                                            |
| 290 ~ 300                               | 106                                            |

| Other Properties                                         |      |
|----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> 105Pa) | 2.77 |
| Specific Gravity $d$                                     | 2.98 |
| Remarks                                                  |      |

| Temperature Coefficients of Refractive Index |                                                                        |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{\text{rel}} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                                   | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | 0.5                                                                    | 0.7 | 1.2 | 1.4 | 1.4 | 1.7 | 2.0 | 2.6 | 2.8 | 3.7 | 4.8 | - |
| -60 ~ -40                                    | 0.4                                                                    | 0.7 | 1.1 | 1.3 | 1.4 | 1.7 | 2.0 | 2.7 | 2.9 | 3.8 | 4.9 | - |
| -40 ~ -20                                    | 0.4                                                                    | 0.6 | 1.2 | 1.4 | 1.5 | 1.8 | 2.1 | 2.8 | 2.9 | 4.0 | 5.2 | - |
| -20 ~ 0                                      | 0.5                                                                    | 0.7 | 1.3 | 1.5 | 1.5 | 1.9 | 2.3 | 3.0 | 3.2 | 4.2 | 5.5 | - |
| 0 ~ 20                                       | 0.6                                                                    | 0.9 | 1.5 | 1.7 | 1.7 | 2.1 | 2.4 | 3.3 | 3.4 | 4.5 | 5.9 | - |
| 20 ~ 40                                      | 0.7                                                                    | 0.9 | 1.6 | 1.9 | 1.9 | 2.3 | 2.7 | 3.5 | 3.6 | 4.8 | 6.2 | - |
| 40 ~ 60                                      | 0.9                                                                    | 1.1 | 1.8 | 2.0 | 2.1 | 2.4 | 2.8 | 3.7 | 3.9 | 5.1 | 6.7 | - |
| 60 ~ 80                                      | 0.9                                                                    | 1.2 | 1.9 | 2.1 | 2.2 | 2.7 | 3.1 | 4.0 | 4.2 | 5.4 | 7.0 | - |
| 80 ~ 100                                     | 1.0                                                                    | 1.3 | 2.0 | 2.3 | 2.3 | 2.7 | 3.2 | 4.2 | 4.3 | 5.7 | 7.3 | - |
| 100 ~ 120                                    | 1.1                                                                    | 1.4 | 2.2 | 2.4 | 2.5 | 2.9 | 3.4 | 4.4 | 4.5 | 5.9 | 7.7 | - |
| 120 ~ 140                                    | 1.2                                                                    | 1.5 | 2.2 | 2.5 | 2.6 | 3.0 | 3.5 | 4.6 | 4.7 | 6.2 | 8.0 | - |
| 140 ~ 160                                    | 1.2                                                                    | 1.5 | 2.3 | 2.6 | 2.6 | 3.2 | 3.7 | 4.8 | 4.9 | 6.4 | 8.2 | - |
| 160 ~ 180                                    | 1.2                                                                    | 1.6 | 2.4 | 2.7 | 2.8 | 3.2 | 3.7 | 4.9 | 5.0 | 6.6 | 8.4 | - |

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## S-TIM35

Code(d) 699301  
Code(e) 704299

|                        |                       |                     |       |                              |           |
|------------------------|-----------------------|---------------------|-------|------------------------------|-----------|
| Refractive Index $n_d$ | 1.698 95<br>1.698 947 | Abbe Number $\nu_d$ | 30.13 | Dispersion $n_F - n_C$       | 0.023 199 |
| Refractive Index $n_e$ | 1.704 424             | Abbe Number $\nu_e$ | 29.89 | Dispersion $n_{F'} - n_{C'}$ | 0.023 567 |

| Refractive Indices |           |          |
|--------------------|-----------|----------|
| $\lambda$ (μm)     |           |          |
| $n_{2325}$         | 2.325 42  | 1.652 83 |
| $n_{1970}$         | 1.970 09  | 1.659 05 |
| $n_{1530}$         | 1.529 58  | 1.666 15 |
| $n_{1129}$         | 1.128 64  | 1.673 35 |
| $n_t$              | 1.013 98  | 1.676 06 |
| $n_s$              | 0.852 11  | 1.681 20 |
| $n_{A'}$           | 0.768 19  | 1.684 96 |
| $n_F$              | 0.706 52  | 1.688 54 |
| $n_C$              | 0.656 27  | 1.692 22 |
| $n_{C'}$           | 0.643 85  | 1.693 27 |
| $n_{He-Ne}$        | 0.632 8   | 1.694 26 |
| $n_D$              | 0.589 29  | 1.698 75 |
| $n_d$              | 0.587 56  | 1.698 95 |
| $n_e$              | 0.546 07  | 1.704 42 |
| $n_F$              | 0.486 13  | 1.715 42 |
| $n_{F'}$           | 0.479 99  | 1.716 84 |
| $n_{He-Cd}$        | 0.441 57  | 1.727 50 |
| $n_g$              | 0.435 835 | 1.729 41 |
| $n_h$              | 0.404 656 | 1.741 89 |
| $n_i$              | 0.365 015 |          |

| Constants of Dispersion Formula |                  |
|---------------------------------|------------------|
| $A_1$                           | 1.558 497 75E+00 |
| $A_2$                           | 2.307 670 07E-01 |
| $A_3$                           | 1.844 360 99E+00 |
| $B_1$                           | 1.153 672 35E-02 |
| $B_2$                           | 5.860 959 47E-02 |
| $B_3$                           | 1.629 818 88E+02 |

| Chemical Properties                       |     |
|-------------------------------------------|-----|
| Water Resistance(Powder) Group RW(P)      | 1   |
| Acid Resistance(Powder) Group RA(P)       | 1   |
| Weathering Resistance(Surface) Group W(S) | 1~2 |
| Acid Resistance(Surface) Group SR         | 1.0 |
| Phosphate Resistance PR                   | 1.0 |

| Mechanical Properties    |       |
|--------------------------|-------|
| Young's Modulus E (GPa)  | 87.5  |
| Rigidity Modulus G (GPa) | 35.3  |
| Poisson's Ratio $\sigma$ | 0.238 |
| Knoop Hardness Hk[Class] | 550 6 |
| Abrasion Aa              | 142   |

| Partial Dispersions |           |
|---------------------|-----------|
| $n_C - n_t$         | 0.016 161 |
| $n_C - n_{A'}$      | 0.007 266 |
| $n_d - n_C$         | 0.006 722 |
| $n_e - n_C$         | 0.012 199 |
| $n_g - n_d$         | 0.030 465 |
| $n_g - n_F$         | 0.013 988 |
| $n_h - n_g$         | 0.012 478 |
| $n_i - n_g$         |           |
| $n_{C'} - n_t$      | 0.017 210 |
| $n_e - n_{C'}$      | 0.011 150 |
| $n_{F'} - n_e$      | 0.012 417 |
| $n_i - n_{F'}$      |           |

| Relative Partial Dispersions |         |
|------------------------------|---------|
| $\theta_{C,t}$               | 0.696 6 |
| $\theta_{C,A'}$              | 0.313 2 |
| $\theta_{d,C}$               | 0.289 8 |
| $\theta_{e,C}$               | 0.525 8 |
| $\theta_{g,d}$               | 1.313 2 |
| $\theta_{g,F}$               | 0.603 0 |
| $\theta_{h,g}$               | 0.537 9 |
| $\theta_{i,g}$               |         |
| $\theta'_{C,t}$              | 0.730 3 |
| $\theta'_{e,C'}$             | 0.473 1 |
| $\theta'_{F,e}$              | 0.526 9 |
| $\theta'_{i,F'}$             |         |

| Anomalous dispersion  |         |
|-----------------------|---------|
| $\Delta\theta_{C,t}$  | 0.008 6 |
| $\Delta\theta_{C,A'}$ | 0.000 8 |
| $\Delta\theta_{g,d}$  | 0.011 1 |
| $\Delta\theta_{g,F}$  | 0.010 3 |
| $\Delta\theta_{i,g}$  |         |

| Coloring              |      |                  |     |
|-----------------------|------|------------------|-----|
| $\lambda_{80}$        | 400  | $\lambda_5$      | 360 |
| $\lambda_{70}$        |      |                  |     |
| Internal transmission |      |                  |     |
| $\lambda_{0.80}$      | 397  | $\lambda_{0.05}$ | 367 |
|                       |      |                  |     |
| CCI                   |      |                  |     |
| B                     | G    | R                |     |
| 0.00                  | 2.94 | 2.98             |     |

| Internal Transmittance |                  |
|------------------------|------------------|
| $\lambda$ (nm)         | $\tau_i$ (10 mm) |
| 280                    |                  |
| 290                    |                  |
| 300                    |                  |
| 310                    |                  |
| 320                    |                  |
| 330                    |                  |
| 340                    |                  |
| 350                    |                  |
| 360                    |                  |
| 370                    | 0.14             |
| 380                    | 0.48             |
| 390                    | 0.72             |
| 400                    | 0.84             |
| 420                    | 0.939            |
| 440                    | 0.964            |
| 460                    | 0.974            |
| 480                    | 0.981            |
| 500                    | 0.986            |
| 550                    | 0.994            |
| 600                    | 0.994            |
| 650                    | 0.993            |
| 700                    | 0.995            |
| 800                    | 0.998            |
| 900                    | 0.999            |
| 1 000                  | 0.999            |
| 1 200                  | 0.999            |
| 1 400                  | 0.995            |
| 1 600                  | 0.995            |
| 1 800                  | 0.988            |
| 2 000                  | 0.980            |
| 2 200                  | 0.942            |
| 2 400                  | 0.931            |

| Thermal Properties                                               |      |
|------------------------------------------------------------------|------|
| Strain Point StP (°C)                                            | 579  |
| Annealing Point AP (°C)                                          | 603  |
| Transformation Temperature Tg (°C)                               | 625  |
| Yield Point At (°C)                                              | 665  |
| Softening Point SP (°C)                                          | 716  |
| Expansion Coefficients (-30 °C ~ 70 °C)                          | 77   |
| $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) (100 °C ~ 300 °C) | 94   |
| Thermal Conductivity $\lambda$ (W/(m·K))                         | 1.05 |

| Linear coefficient of thermal expansion |                                                |
|-----------------------------------------|------------------------------------------------|
| Temperature range (°C)                  | $\alpha_i$ (10 <sup>-7</sup> K <sup>-1</sup> ) |
| -100 ~ -90                              | 63                                             |
| -90 ~ -80                               | 64                                             |
| -80 ~ -70                               | 65                                             |
| -70 ~ -60                               | 67                                             |
| -60 ~ -50                               | 68                                             |
| -50 ~ -40                               | 69                                             |
| -40 ~ -30                               | 71                                             |
| -30 ~ -20                               | 72                                             |
| -20 ~ -10                               | 73                                             |
| -10 ~ 0                                 | 74                                             |
| 0 ~ 10                                  | 75                                             |
| 10 ~ 20                                 | 77                                             |
| 20 ~ 30                                 | 78                                             |
| 30 ~ 40                                 | 79                                             |
| 40 ~ 50                                 | 80                                             |
| 50 ~ 60                                 | 81                                             |
| 60 ~ 70                                 | 82                                             |
| 70 ~ 80                                 | 83                                             |
| 80 ~ 90                                 | 84                                             |
| 90 ~ 100                                | 85                                             |
| 100 ~ 110                               | 86                                             |
| 110 ~ 120                               | 87                                             |
| 120 ~ 130                               | 88                                             |
| 130 ~ 140                               | 89                                             |
| 140 ~ 150                               | 90                                             |
| 150 ~ 160                               | 91                                             |
| 160 ~ 170                               | 92                                             |
| 170 ~ 180                               | 92                                             |
| 180 ~ 190                               | 93                                             |
| 190 ~ 200                               | 94                                             |
| 200 ~ 210                               | 95                                             |
| 210 ~ 220                               | 95                                             |
| 220 ~ 230                               | 96                                             |
| 230 ~ 240                               | 97                                             |
| 240 ~ 250                               | 97                                             |
| 250 ~ 260                               | 98                                             |
| 260 ~ 270                               | 99                                             |
| 270 ~ 280                               | 99                                             |
| 280 ~ 290                               | 100                                            |
| 290 ~ 300                               | 100                                            |

| Other Properties                                          |      |
|-----------------------------------------------------------|------|
| Photoelastic Constant $\beta$ nm/(cm <sup>3</sup> ·105Pa) | 3.04 |
| Specific Gravity $d$                                      | 2.96 |
| Remarks                                                   |      |

| Temperature Coefficients of Refractive Index |                                                                 |     |     |     |     |     |     |     |     |     |     |   |
|----------------------------------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Range of Temperature (°C)                    | $\Delta n_{rel} / \Delta T$ (10 <sup>-6</sup> K <sup>-1</sup> ) |     |     |     |     |     |     |     |     |     |     |   |
|                                              | 1550                                                            | t   | r   | C   | C'  | d   | e   | F   | F'  | g   | h   | i |
| -80 ~ -60                                    | 1.1                                                             | 1.3 | 1.8 | 2.0 | 2.0 | 2.3 | 2.6 | 3.3 | 3.4 | 4.4 | 5.6 | - |
| -60 ~ -40                                    | 1.0                                                             | 1.3 | 1.7 | 1.9 | 2.0 | 2.2 | 2.7 | 3.4 | 3.5 | 4.5 | 5.8 | - |
| -40 ~ -20                                    | 1.0                                                             | 1.3 | 1.8 | 2.0 | 2.1 | 2.4 | 2.7 | 3.5 | 3.7 | 4.7 | 6.0 | - |
| -20 ~ 0                                      | 1.1                                                             | 1.4 | 2.0 | 2.2 | 2.2 | 2.6 | 2.9 | 3.7 | 3.8 | 4.9 | 6.4 | - |
| 0 ~ 20                                       | 1.2                                                             | 1.5 | 2.1 | 2.3 | 2.4 | 2.7 | 3.1 | 3.9 | 4.0 | 5.3 | 6.7 | - |
| 20 ~ 40                                      | 1.3                                                             | 1.6 | 2.3 | 2.5 | 2.6 | 2.9 | 3.3 | 4.2 | 4.3 | 5.6 | 7.0 | - |
| 40 ~ 60                                      | 1.5                                                             | 1.8 | 2.4 | 2.7 | 2.7 | 3.1 | 3.5 | 4.4 | 4.6 | 5.8 | 7.5 | - |
| 60 ~ 80                                      | 1.6                                                             | 1.9 | 2.5 | 2.8 | 2.8 | 3.3 | 3.8 | 4.7 | 4.9 | 6.2 | 7.8 | - |
| 80 ~ 100                                     | 1.7                                                             | 2.0 | 2.7 | 2.9 | 3.0 | 3.4 | 3.9 | 5.0 | 5.1 | 6.5 | 8.2 | - |
| 100 ~ 120                                    | 1.8                                                             | 2.1 | 2.8 | 3.1 | 3.1 | 3.6 | 4.0 | 5.1 | 5.2 | 6.8 | 8.5 | - |
| 120 ~ 140                                    | 1.8                                                             | 2.1 | 2.9 | 3.2 | 3.2 | 3.7 | 4.2 | 5.2 | 5.5 | 7.0 | 8.8 | - |
| 140 ~ 160                                    | 1.8                                                             | 2.2 | 3.0 | 3.3 | 3.4 | 3.9 | 4.3 | 5.5 | 5.6 | 7.2 | 9.1 | - |
| 160 ~ 180                                    | 1.9                                                             | 2.2 | 3.0 | 3.3 | 3.4 | 3.9 | 4.4 | 5.5 | 5.7 | 7.3 | 9.3 | - |

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