

The Future Made Clear



VAD-BASED ANHYDROUS SYNTHETIC FUSED SILICA SK-1310



SK-1310 Fused Silica

SK-1310 is the anhydrous synthetic fused silica among the SK-1300 series products of VAD-based synthetic fused silica. In addition to the high reliability of heat resistance, mechanical strength, and chemical resistance maintained by SK-1300, photolytic absorption is not generated to the infrared area of 2.73 μm , because it doesn't contain hydrogenous radicals. SK-1310 products are fully renovated materials with the maximum transmission applicable to the entire ultraviolet, visible and infrared areas. The physical and chemical characteristics are prominent similar to the SK-1300 products in a broad range of applications in advanced technological industries such as semiconductors and optics.

1. Optical fibers
2. Optical elements for ultraviolet and infrared lenses or windows
3. All types of cells for ultraviolet or infrared transmission of entire areas of spectrophotometer
4. Electrical-discharge lamp tubing

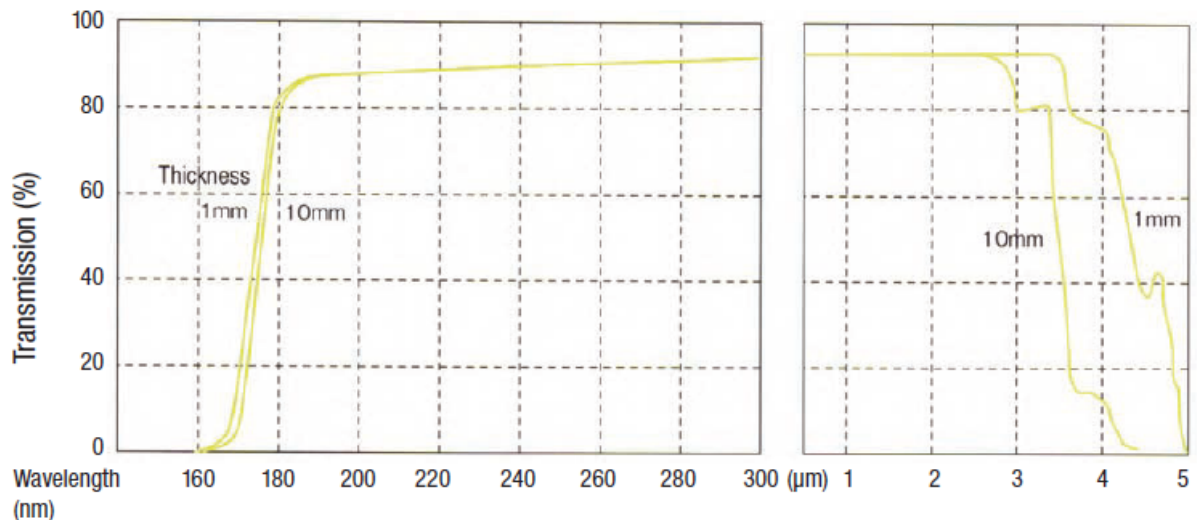
| | | Element | Analytical Value | Element | Analytical Value | | |
|----------------------------------|-----|---------|------------------|---------|------------------|----|--------------|
| Typical Impurity Analysis | ppm | Al | <0.01 | Co | <0.01 | | |
| | | Fe | <0.01 | Ni | <0.01 | | |
| | | Ti | <0.01 | P | <0.01 | | |
| | | Ca | <0.01 | B | <0.01 | | |
| | | Mg | <0.01 | Na | <0.01 | | |
| | | Mn | <0.01 | K | <0.01 | | |
| | | Cr | <0.01 | Li | <0.01 | | |
| | | Cu | <0.01 | Zr | <0.01 | | |
| | | | | OH | <1 | Cl | \cong 1000 |

| | Solution | Treatment Temperatures (°C) | Hours (H) | Weight Loss (mg/cm ²) |
|----------------------------|--------------------------|-----------------------------|-----------|-----------------------------------|
| Chemical Resistance | H ₂ O | 95°C | 45H | 0.0001~0.0002mg/cm ² |
| | 1/100 N HNO ₃ | 115°C | 24H | 0.005~0.01mg/cm ² |
| | 5% NaOH | 100°C | 10H | 1.30mg/cm ² |

The Future Made Clear



Transmission



| | Wavelength (nm) | 15°C | 25°C | 35°C |
|--|-----------------|------|------|------|
|--|-----------------|------|------|------|

Refractive Index

| | | | |
|-----------|--------|--------|--------|
| 237.83 | 1.5156 | 1.5157 | 1.5158 |
| 248.20 | 1.5093 | 1.5094 | 1.5095 |
| 274.87 | 1.4967 | 1.4968 | 1.4969 |
| 334.15 | 1.4805 | 1.4806 | 1.4807 |
| 365.48(i) | 1.4753 | 1.4754 | 1.4755 |
| 404.65(h) | 1.4704 | 1.4705 | 1.4706 |
| 435.83(g) | 1.4674 | 1.4675 | 1.4676 |
| 546.07(e) | 1.4608 | 1.4609 | 1.4610 |

| Item | Grade |
|------|-------|
|------|-------|

Optical Qualities

| | |
|------------------------|---|
| Bubbles | 0~0.03mm ² /100cm ³ |
| Striae | Grade A in one direction (As per Mil-G-174) |
| Birefringence (Strain) | 10nm/cm and under |

| Item | Unit | Value | Item | Unit | Value |
|------|------|-------|------|------|-------|
|------|------|-------|------|------|-------|

Physical Properties

| | | | | | |
|----------------------|-------------------|----------|----------------------------------|---------|----------------------|
| Density | g/cm ³ | 2.20 | Coefficient of thermal expansion | 1/K | 5.5×10 ⁻⁷ |
| Young's module | GPa | 71.6 | Softening point | °C | 1700 |
| Torsional rigidity | GPa | 31.4 | Annealing point | °C | 1160 |
| Poisson's ratio | | 0.17 | Strain point | °C | 1060 |
| Compression strength | GPa | 1.1 | Specific heat (26°C) | kJ/kg·K | 0.74 |
| Bending strength | MPa | 69 | | | |
| Tensile strength | MPa | 55 | | | |
| Vickers hardness | GPa | 8.8~10.1 | | | |

Please contact us to discuss your specific requirements.

GET IN TOUCH

www.oharacorp.com

50 Columbia Road
Branchburg, NJ 08876
Tel: (908) 218-0100
Fax: (908) 218-1685

23141 Arroyo Vista #200
Rancho Santa Margarita, CA 92688
Tel: (949) 858-5700
Fax: (949) 858-5455

SK-1310

Glass Data Sheet

Code(d) **459678**
Code(e) **460677**

| | | | | | |
|------------------------|----------------|-------------------|-------------|-------------------------|----------------|
| Refractive Index n_d | 1.45866 | Abbe Number v_d | 67.8 | Dispersion n_F-n_C | 0.00676 |
| | 1.458663 | | 67.85 | | 0.006760 |
| Refractive Index n_e | 1.460277 | Abbe Number v_e | 67.71 | Dispersion $n_F-n_{C'}$ | 0.006798 |

| Refractive Indices(at 25°C,Air,1013hPa) | | |
|---|-----------------|----------------|
| $\lambda(\mu\text{m})$ | | |
| n_{2325} | 2.32542 | 1.43320 |
| n_{1970} | 1.97009 | 1.43876 |
| n_{1530} | 1.52958 | 1.44449 |
| n_{1129} | 1.12864 | 1.44908 |
| n_t | 1.01398 | 1.45045 |
| n_s | 0.85211 | 1.45267 |
| $n_{A'}$ | 0.76819 | 1.45409 |
| n_r | 0.70652 | 1.45535 |
| n_C | 0.65627 | 1.45657 |
| $n_{C'}$ | 0.64385 | 1.45690 |
| n_{He-Ne} | 0.63280 | 1.45722 |
| n_D | 0.58929 | 1.45860 |
| n_d | 0.58756 | 1.45866 |
| n_e | 0.54607 | 1.46028 |
| n_F | 0.48613 | 1.46333 |
| $n_{F'}$ | 0.47999 | 1.46370 |
| n_{He-Cd} | 0.44157 | 1.46642 |
| n_g | 0.435835 | 1.46689 |
| n_h | 0.404656 | 1.46982 |
| n_i | 0.365015 | 1.47475 |
| n_{KrF^*} | 0.248500 | 1.50849 |
| n_{ArF^*} | 0.193300 | 1.56051 |

| Deviation of Relative Dispersions $\Delta\theta$ from "Normal" | |
|--|---------|
| $\Delta\theta_{C,t}$ | 0.0400 |
| $\Delta\theta_{C,A'}$ | 0.0082 |
| $\Delta\theta_{g,d}$ | -0.0063 |
| $\Delta\theta_{g,F}$ | -0.0040 |
| $\Delta\theta_{i,g}$ | 0.0048 |

| Constants of Dispersion Formula | |
|---------------------------------|----------------|
| A_1 | 7.50110530E-01 |
| A_2 | 3.54568578E-01 |
| A_3 | 9.18389018E-01 |
| B_1 | 4.97286260E-03 |
| B_2 | 1.42109021E-02 |
| B_3 | 1.00468940E+02 |

| Other Properties | |
|----------------------|------|
| Bubble Quality Group | 1 |
| Specific Gravity | 2.20 |
| Remarks | |

| Temperature Coefficients of Refractive Index | | | | | | | |
|--|---------------------------------------|------|-------|------|------|------|------|
| Range of Temperature (°C) | dn/dt relative (10 ⁻⁶ /°C) | | | | | | |
| | t | C' | He-Ne | D | e | F' | g |
| -40~0 | - | - | - | - | - | - | - |
| 0~20 | - | - | - | - | - | - | - |
| 20~25 | 9.7 | 10.1 | 10.0 | 10.1 | 10.2 | 10.5 | 10.7 |
| 20~40 | - | - | - | - | - | - | - |
| 40~60 | - | - | - | - | - | - | - |

| Partial Dispersions | |
|---------------------|----------|
| n_C-n_t | 0.006118 |
| $n_C-n_{A'}$ | 0.002476 |
| n_d-n_C | 0.002097 |
| n_e-n_C | 0.003711 |
| n_g-n_d | 0.008230 |
| n_g-n_F | 0.003567 |
| n_h-n_g | 0.002927 |
| n_i-n_g | 0.007853 |
| n_C-n_t | 0.006456 |
| $n_e-n_{C'}$ | 0.003373 |
| n_F-n_e | 0.003425 |
| $n_i-n_{F'}$ | 0.011044 |

| Thermal Properties | |
|--|------|
| Strain Point StP (°C) | 1060 |
| Annealing Point AP (°C) | 1160 |
| Softening Point SP (°C) | 1600 |
| Expansion Coefficients (+0~+200°C) | 5.5 |
| α (10 ⁻⁷ /°C) (+100~+300°C) | - |
| Thermal Conductivity k (W/m·K) | 1.3 |
| Specific heat capacity c (J/kg·K) | 736 |
| Thermal diffusivity (10 ⁻⁷ m ² /s) | 8.04 |

| Mechanical Properties | |
|--|---------|
| Young's Modulus E (10 ⁸ N/m ²) | 725 |
| Rigiditv Modulus G (10 ⁸ N/m ²) | 310 |
| Poisson's Ratio σ | 0.17 |
| Knoop Hardness Hk[Class] | 660 7 |
| Abrasion Aa | - |
| Photoelastic Constant β (nm/cm/10 ⁵ Pa) | 3.5 |

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

| Electrical Properties | |
|--|--------|
| Dielectric constant ϵ | 4.0 |
| Dielectric tangent $\tan\delta$ | 0.0004 |
| Volume resistivity($\Omega\cdot\text{cm}$) | >1E+16 |

| Impurities | |
|------------------|-------|
| OH content (ppm) | <1 |
| Cl content (ppm) | <2000 |

| Relative Partial Dispersions | |
|------------------------------|--------|
| $\theta_{C,t}$ | 0.905 |
| $\theta_{C,A'}$ | 0.3663 |
| $\theta_{d,C}$ | 0.3102 |
| $\theta_{e,C}$ | 0.549 |
| $\theta_{g,d}$ | 1.2175 |
| $\theta_{g,F}$ | 0.5277 |
| $\theta_{h,g}$ | 0.433 |
| $\theta_{i,g}$ | 1.1617 |
| $\theta'_{C,t}$ | 0.9497 |
| $\theta'_{e,C'}$ | 0.4962 |
| $\theta'_{F,e}$ | 0.5038 |
| $\theta'_{i,F}$ | 1.6246 |

| Coloring | | | |
|----------------|------|-------------|------|
| λ_{80} | ~180 | λ_5 | ~180 |
| λ_{70} | ~180 | | |

~180:Less than 180nm

| Internal Transmittance | |
|------------------------|----------------------|
| $\lambda(\text{nm})$ | $\tau_{10\text{mm}}$ |
| 172* | 0.662 |
| 193* | 0.991 |
| 248* | 0.999~ |
| 250 | 0.999~ |
| 260 | 0.999~ |
| 270 | 0.999~ |
| 280 | 0.999~ |
| 290 | 0.999~ |
| 300 | 0.999~ |
| 320 | 0.999~ |
| 340 | 0.999~ |
| 360 | 0.999~ |
| 365* | 0.999~ |
| 380 | 0.999~ |
| 400 | 0.999~ |
| 450 | 0.999~ |
| 500 | 0.999~ |
| 550 | 0.999~ |
| 587* | 0.999~ |
| 600 | 0.999~ |
| 650 | 0.999~ |
| 700 | 0.999~ |
| 800 | 0.999~ |
| 900 | 0.999~ |
| 1000 | 0.999~ |
| 1129* | 0.999~ |
| 1200 | 0.999~ |
| 1400 | 0.999~ |
| 1530* | 0.999~ |
| 1600 | 0.999~ |
| 1800 | 0.999~ |
| 1970* | 0.999~ |
| 2000 | 0.999~ |
| 2326* | 0.998 |
| 2400 | 0.995 |
| 2500 | 0.992 |

0.999~:better than 0.999

*Precision Measurements

Rev.F DATE 2018/10/24