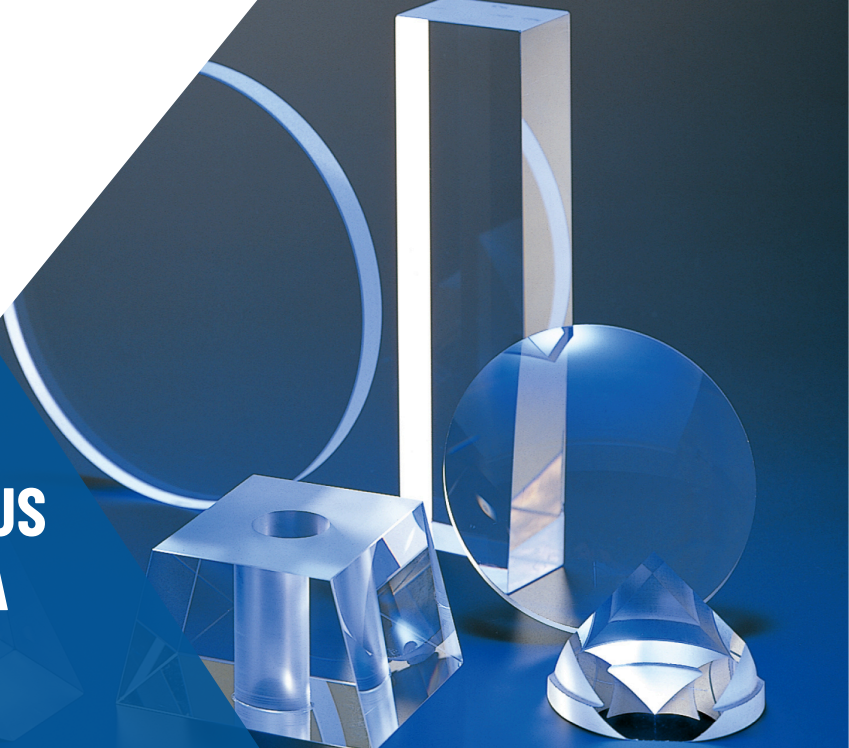


The Future Made Clear



VAD-PROCESS ANHYDROUS SYNTHETIC FUSED SILICA SK-1300



SK-1300 Fused Silica

OHARA successfully developed synthetic fused silica SK-1300 as a result of significant improvements made to the conventional VAD (vapor-phase axial deposition) method of optical fiber manufacturing technology. SK-1300 is extremely high in purity and much lower in OH content thus making it the first synthetic fused silica usable in the semiconductor and liquid crystal display industries. SK-1300 is state-of-the-art in optical characteristics because it provides a high UV transmission, no micro inclusions, and solarization resistance, in addition to heat resistance, mechanical strength, and chemical resistance. These products can be used in a wide variety of industrial applications for semiconductors, optical and all physical or chemical related research featuring these applications:

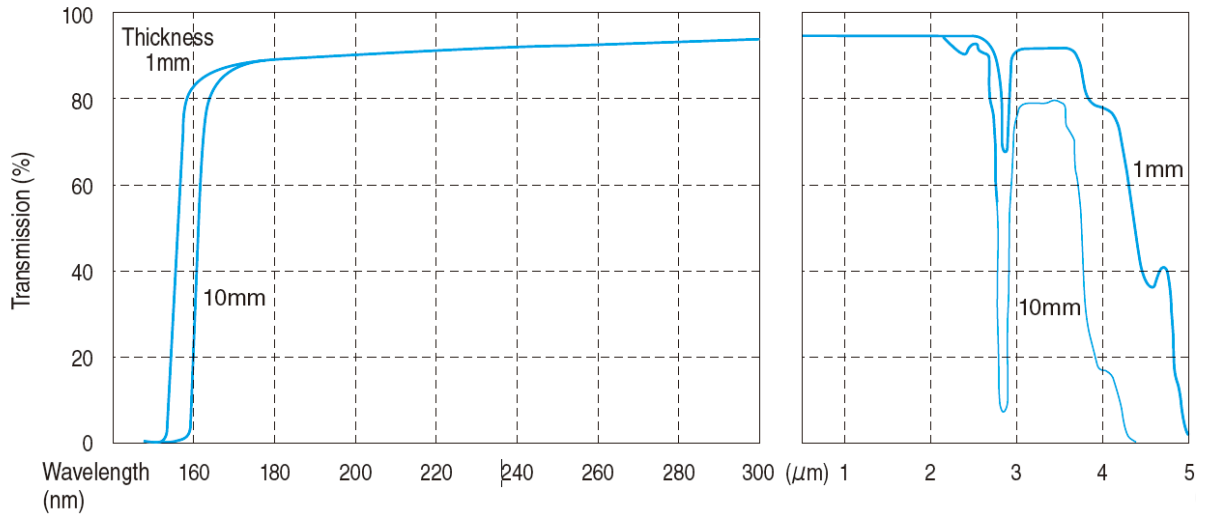
1. Various devices such as TFT (poly-Si thin-film transistor LCD) and SOI (Silicon on Insulator).
2. Photomask substrates for ultra-LSI and LCD.
3. Reactor furnace tubes, jigs and tools for ULSI manufacturing processes.
4. Electrical-discharge lamp tubes.
5. Optical elements, lenses, mirrors, and windows for ultraviolet and vacuum ultraviolet.

| | | Element | Analytical Value | Element | Analytical Value |
|----------------------------------|-----|---------|------------------|---------|------------------|
| Typical Impurity Analysis | ppb | Al | <10 | Co | <10 |
| | | Fe | <10 | Ni | <10 |
| | | Ti | <10 | P | <10 |
| | | Ca | <10 | B | <10 |
| | | Mg | <10 | Na | <10 |
| | | Mn | <10 | K | <10 |
| | | Cr | <10 | Li | <10 |
| | | Cu | <10 | Zr | <10 |
| | | OH | <200 | Cl | <1 |

| | Solution | Treatment Temperatures (°C) | Hours | Weight Loss (mg/cm ²) |
|----------------------------|--------------------------|-----------------------------|-------|-----------------------------------|
| Chemical Resistance | H ₂ O | 95 | 45 | 0.0001~0.0002 |
| | 1/100 N HNO ₃ | 115 | 24 | 0.005~0.01 |
| | 5% NaOH | 100 | 10 | 1.35 |



Transmission



| | Wavelength (nm, in air) | 25°C in air | 20°C in air | 20-5°C in air Wavelength (nm, in air) | 1×10 ⁻⁶ /°C dn/dT |
|--|-------------------------|-------------|--|--|---------------------------------|
| Refractive Index | 365.015 (i) | 1.47465 | 1.47459 | 365.015 (i) | 11.2 |
| | 404.656 (h) | 1.46972 | 1.46967 | 404.656 (h) | 10.8 |
| | 435.835 (g) | 1.46680 | 1.46675 | 435.835 (g) | 10.6 |
| | 486.133 (F) | 1.46323 | 1.46318 | 486.133 (F) | 10.3 |
| | 546.075 (e) | 1.46018 | 1.46013 | 546.075 (e) | 10.1 |
| | 587.562 (d) | 1.45857 | 1.45852 | 587.562 (d) | 10.0 |
| | 656.273 (C) | 1.45647 | 1.45642 | 656.273 (C) | 9.9 |
| Measuring accuracy ±5×10 ⁻⁶ | | | Measuring accuracy ±0.6×10 ⁻⁶ | | |

| | 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 |
| | Fluorescence | Not permitted (Excited wavelength 254nm) |

| | Item | Unit | Value | Item | Unit | Value |
|----------------------------|----------------------|-------------------|----------|----------------------------------|---------------|----------------------|
| Physical Properties | Density | g/cm ³ | 2.2 | Coefficient of thermal expansion | 1/K | 5.5×10 ⁻⁷ |
| | Young's module | GPa | 72.4 | Softening point | °C | 1600 |
| | Torsional rigidity | GPa | 30.9 | Annealing point | °C | 1160 |
| | Poisson's ratio | | 0.17 | Strain point | °C | 1060 |
| | Compression strength | GPa | 1.1 | Specific heat (25°C) | kJ/kg·K | 0.73 |
| | Bending strength | MPa | 69 | Thermal conductivity ratio | (25°C) W/m·K | 1.3 |
| | Tensile strength | MPa | 55 | | (100°C) W/m·K | 1.4 |
| | Vickers hardness | GPa | 8.8~10.1 | | | |
| | Knoop hardness | GPa | 6.4~7.0 | | | |

GET IN TOUCH

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SK-1300 Series Glass Data Sheet

Code(d) **459678**

Code(e) **460677**

| | | | | | |
|------------------------|----------------------------|-------------------|----------------------|-------------------------|----------------------------|
| Refractive Index n_d | 1.45857 1.458567 | Abbe Number v_d | 67.8 67.84 | Dispersion n_F-n_C | 0.00676 0.006760 |
| Refractive Index n_e | 1.460181 | Abbe Number v_e | 67.68 | Dispersion $n_F-n_{C'}$ | 0.006799 |

| Refractive Indices(at 25°C,Air,1013hPa) | | |
|---|----------------|----------------|
| $\lambda(\mu\text{m})$ | | |
| n_{2325} | 2.32542 | 1.43307 |
| n_{1970} | 1.97009 | 1.43864 |
| n_{1530} | 1.52958 | 1.44438 |
| n_{1129} | 1.12864 | 1.44898 |
| n_t | 1.01398 | 1.45035 |
| n_s | 0.85211 | 1.45257 |
| $n_{A'}$ | 0.76819 | 1.45399 |
| n_r | 0.70652 | 1.45525 |
| n_C | 0.65627 | 1.45647 |
| $n_{C'}$ | 0.64385 | 1.45681 |
| n_{He-Ne} | 0.63280 | 1.45712 |
| n_D | 0.58929 | 1.45851 |
| n_d | 0.58756 | 1.45857 |
| n_e | 0.54607 | 1.46018 |
| n_F | 0.48613 | 1.46323 |
| $n_{F'}$ | 0.47999 | 1.46361 |
| n_{He-Cd} | 0.44157 | 1.46633 |
| n_g | 0.435835 | 1.46680 |
| n_h | 0.404656 | 1.46972 |
| n_i | 0.365015 | 1.47465 |
| n_{KrF^*} | 0.24850 | 1.50840 |
| n_{ArF^*} | 0.19330 | 1.56041 |

| Deviation of Relative Dispersions $\Delta\theta$ from "Normal" | |
|--|---------|
| $\Delta\theta_{C,t}$ | 0.0406 |
| $\Delta\theta_{C,A'}$ | 0.0085 |
| $\Delta\theta_{g,d}$ | -0.0063 |
| $\Delta\theta_{g,F}$ | -0.0040 |
| $\Delta\theta_{i,g}$ | 0.0042 |

| Constants of Dispersion Formula | |
|---------------------------------|----------------|
| A_1 | 7.92122197E-01 |
| A_2 | 3.12281689E-01 |
| A_3 | 9.14368121E-01 |
| B_1 | 5.26428733E-03 |
| B_2 | 1.47301780E-02 |
| B_3 | 9.98720100E+01 |

| 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 | 9.6 | 9.8 | 10.0 | 10.0 | 10.1 | 10.4 | 10.6 |
| 20~40 | - | - | - | - | - | - | - |
| 40~60 | - | - | - | - | - | - | - |

| Partial Dispersions | |
|---------------------|----------|
| n_C-n_t | 0.006122 |
| $n_C-n_{A'}$ | 0.002478 |
| 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 | 0.002925 |
| n_i-n_g | 0.007850 |
| n_C-n_t | 0.006459 |
| $n_e-n_{C'}$ | 0.003374 |
| n_F-n_e | 0.003425 |
| $n_i-n_{F'}$ | 0.011041 |

| 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) | 734 |
| Thermal diffusivity (10 ⁻⁷ m ² /s) | 8.05 |

| Mechanical Properties | |
|--|---------|
| Young's Modulus E (10 ⁸ N/m ²) | 724 |
| Rigidiv Modulus G (10 ⁸ N/m ²) | 309 |
| Poisson's Ratio σ | 0.17 |
| Knoop Hardness Hk[Class] | 650 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) | <200 |
| Cl content (ppm) | <1 |

| Relative Partial Dispersions | |
|------------------------------|--------|
| $\theta_{C,t}$ | 0.9056 |
| $\theta_{C,A'}$ | 0.3666 |
| $\theta_{d,C}$ | 0.3102 |
| $\theta_{e,C}$ | 0.5490 |
| $\theta_{g,d}$ | 1.2175 |
| $\theta_{g,F}$ | 0.5277 |
| $\theta_{h,g}$ | 0.4327 |
| $\theta_{i,g}$ | 1.1612 |
| $\theta'_{C,t}$ | 0.9500 |
| $\theta'_{e,C'}$ | 0.4962 |
| $\theta'_{F,e}$ | 0.5038 |
| $\theta'_{i,F}$ | 1.6239 |

| Coloring | | | |
|----------------|------|-------------|------|
| λ_{80} | ~165 | λ_5 | ~165 |
| λ_{70} | ~165 | | |

~165:Less than 165nm

| Internal Transmittance | |
|------------------------|----------------------|
| $\lambda(\text{nm})$ | $\tau_{10\text{mm}}$ |
| 172* | 0.983 |
| 193* | 0.997 |
| 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 | 0.998 |
| 1530* | 0.999~ |
| 1600 | 0.999~ |
| 1800 | 0.999~ |
| 1970* | 0.999~ |
| 2000 | 0.999~ |
| 2326* | 0.994 |
| 2400 | 0.991 |
| 2500 | 0.982 |

0.999~:better than 0.999

*Precision Measurements

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