

Standard Optics Information

POL-O/422M-E
06/94

SUPRASIL[®] 1, 2 (Grade A & B)

1. GENERAL PRODUCT DESCRIPTION

Heraeus SUPRASIL 1 and 2 (Grade A & B) are high purity synthetic fused silica materials manufactured by flame hydrolysis of SiCl_4 . They combine excellent physical properties with outstanding optical characteristics in the deep UV and the visible wavelength range. The index homogeneity is controlled and specified either in one direction (the direction of use or functional direction) or even in all three dimensions. In addition, the materials provide excellent resistance to damage by high energy UV laser radiation.

All synthetic fused silica SUPRASIL grades are practically free from bubbles and inclusions.

The optical homogeneity, which is the main criterion for very low transmitted wavefront distortion, refers to three categories:

- SUPRASIL 1 is an optically isotropic 3D-material. It is highly homogeneous and has no striations in all three dimensions. These properties are very important for multiple axis optics such as prisms, steep lenses, beam splitters or etalons.
- SUPRASIL 2 Grade A & B are homogeneous in the primary functional direction. Weak striations, if any, are parallel to the major faces and do not affect the optical performance.
SUPRASIL 2 Grade A & B are the preferred materials for demanding optics in one directional use such as lenses, UV-laser windows, optical flats, etc.

For general technical data please refer to our data sheet "Quartz Glass for Optics - Data and Properties" HQS-SO-DS-05.05

POL-O/422M-E
06/94

Standard Optics Information

2. OPTICAL DATA OF SUPRASIL 1& 2 (Grade A & B)

2.1 Bubbles and Inclusions

(Bubbles and Inclusions ≤ 0.08 mm diameter are disregarded)

2.1.1 Bubble class : better than 0 (as per DIN 58927 2/70)

i. e. total bubble cross section within the volume is ≤ 0.03 mm²/100 cm³.

2.1.2 Bubbles according to DIN ISO 10100

SUPRASIL 1	:	1 / 2*0,10	for pieces < 6 kg
SUPRASIL 2 Grade A & B	:	1 / 1*0,16 1 / 1*0,25	for pieces < 6 kg for pieces 6 -30

2.1.3 Inclusions : None

2.1.4 Spots : None

2.2 Refractive Index and Dispersion

2.2.1 Refractive Index

n_C	=	1.45637	at	656.3 nm
n_d	=	1.45846	at	587.6 nm
n_F	=	1.46313	at	486.1 nm
n_g	=	1.46669	at	435.8 nm
n	=	1.50855	at	248 nm

At 20°C, 1 bar atmospheric pressure

Accuracy: $\pm 3 \cdot 10^{-5}$

POL-O/422M-E
06/94

Standard Optics Information

2.2.2 Dispersion

$$n_F \text{ @ } n_C = 0.00676$$

$$V_d = \frac{n_d - 1}{n_F - n_C} = 67.8 \pm 0.5$$

2.3 Optical Homogeneity

2.3.1 Granular Structure: None

2.3.2 Striations

SUPRASIL 1 : In all three dimensions free from striations, i.e. better than grade A, MIL-G-174-B.

SUPRASIL 2 Grade A & B: In primary functional direction free from striations, i. e. grade A, MIL-G-174-B; weak striations, if any, are parallel to the major faces.

2.3.3 Index Homogeneity

Specified across 90% of diameter or sidelength for machined parts, respectively 80% for raw formed ingots.

SUPRASIL 1 : In all three dimensions guaranteed total $\Delta n \leq 5 \cdot 10^{-6}$; with power subtracted Δn (p.s.) $\leq 2 \cdot 10^{-6}$; on special request total $\Delta n \leq 2 \cdot 10^{-6}$.

(Maximum weight ca. 10 kg; larger pieces available on request).

SUPRASIL 2 Grade A : In primary functional direction guaranteed total $\Delta n \leq 5 \cdot 10^{-6}$; with power subtracted Δn (p.s.) $\leq 2 \cdot 10^{-6}$; on special request total $\Delta n \leq 1 \cdot 10^{-6}$.

(No special limits on size and weight).

SUPRASIL 2 Grade B : In primary functional direction guaranteed total $\Delta n \leq 10 \cdot 10^{-6}$; with power subtracted Δn (p.s.) $\leq 5 \cdot 10^{-6}$; (No special limits on size and weight).

POL-O/422M-E
06/94

Standard Optics Information

Δn (p.s.) (power subtracted) is calculated by subtracting from a measured Δn distribution the proportion that gives an exactly spherical aberration of an originally plane optical phasefront. This subtraction procedure is built into most modern interferometer software as an option.

2.4 Residual Strain

SUPRASIL 1, 2 (Grade A & B) : ≤ 5 nm/cm across 80% of diameter or side length
 $\leq 5...15$ nm/cm in the rim area.

2.5 Spectral Transmittance

2.5.1 For typical transmission curves (including Fresnel reflection losses) for a 10 mm path length are shown in the figure please refer to our data sheet "Quartz Glass for Optics - Data and Properties" HQS-SO-DS-05.05

2.5.2 Decadic Extinction Coefficient at 200 nm

$k_{200} < 0.005 \text{ cm}^{-1}$ (typical)
 $k_{200} < 0.01 \text{ cm}^{-1}$ (guaranteed)

Using the definition:

Transmittance $T = 10^{-kd}$
with d = thickness of sample

2.5.3 Infrared Absorption

OH absorption bands occur at wavelengths around 1.39 μm , 2.2 μm , and 2.72 μm according to an OH content of less than 1000 ppm (weight).

POL-O/422M-E
06/94

Standard Optics Information

2.6 **Fluorescence:** None

With 254 nm excitation (low pressure Hg lamp and Schott UG 5 filter) and visual inspection.

2.7 **Radiation Resistance**

Excellent resistance to damage by high energy UV-laser radiation.

High laser damage threshold.

No degradation of visible transmittance after exposure to Co⁶⁰ γ -radiation (1.15 MeV) with 0.063 Mrad/h for 98 h.