POL-O/423M-E
06/94

INFRASIL Ò 301, 302 and 303

1. GENERAL PRODUCT DESCRIPTION

Heraeus INFRASIL 301, 302 and 303 are optical quartz glass grades manufactured by fusion of natural quartz crystals in an electrically heated furnace. They combine excellent physical properties with outstanding optical characteristics especially in the IR 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.

All INFRASIL grades show a low bubble and inclusion content. INFRASIL 301 meets the requirements for bubble class 0.

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

- INFRASIL 301 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.

- INFRASIL 302 and 303 are homogeneous in the primary functional direction. Weak striations, if any, are parallel to the major faces and do not affect the optical performance.

  INFRASIL 302 is the preferred material for demanding optics in one directional use such as lenses, IR-laser windows, optical flats, etc.

  INFRASIL 303 is designed for commercial optical infrared applications such as lightguide elements, beam delivery elements, microscope slides and IR-windows.

For general technical data please refer to our data sheet POL-O/107E "Quartz Glass for Optics - Data and Properties".

2. OPTICAL DATA OF INFRASIL 301, 302 and 303

2.1 Bubbles and Inclusions

(Bubbles ≤ 0.08 mm diameter are disregarded)

2.1.1 Bubble class (as per DIN 58927 2/70)

INFRASIL 301	:	0
INFRASIL 302	:	0....1
INFRASIL 303	:	1

2.1.2 Maximum bubble diameter

INFRASIL 301	:	≤ 0.15 mm	for pieces ≤ 6 kg
INFRASIL 302	:	≤ 0.20 mm	for pieces ≤ 6 kg
		≤ 0.50 mm	for pieces > 6 - 30 kg
INFRASIL 303	:	≤ 0.30 mm	for pieces ≤ 6 kg
		≤ 0.60 mm	for pieces > 6 - 30 kg

2.1.3 Inclusions : None

2.1.4 Spots : None

2.2 Refractive Index and Dispersion

2.2.1 Refractive Index

n_C = 1.45646 at 656.3 nm
n_d = 1.45856 at 587.6 nm
n_F = 1.46324 at 486.1 nm
n_g = 1.46681 at 435.8 nm

At 20°C, 1 bar atmospheric pressure
Accuracy: $\pm 3 \cdot 10^{-5}$

2.2.2 Dispersion

$n_F - n_C = 0.00678$

$$n_d = \frac{n_d - 1}{n_F - n_C} = 67.6 \pm 0.5$$

2.3 Optical Homogeneity

2.3.1 Granular Structure: None

2.3.2 Striations

INFRASIL 301 : In all three dimensions free from striations, i.e. better than grade A, MIL-G-174-B.

INFRASIL 302 and 303 : 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.

INFRASIL 301 : In all three dimensions guaranteed total $\Delta n \leq 5 \bullet 10^{-6}$; with power subtracted Δn (p.s.) $\leq 4 \bullet 10^{-6}$; on special request total $\Delta n \leq 2 \bullet 10^{-6}$.

(Maximum weight ca. 6 kg; larger pieces available on request).

INFRASIL 302 : In primary functional direction guaranteed total $\Delta n \leq 6 \bullet 10^{-6}$; with power subtracted Δn (p.s.) $\leq 4 \bullet 10^{-6}$; on special request total $\Delta n \leq 3 \bullet 10^{-6}$.

(No special limits on size and weight).

INFRASIL 303 : In primary functional direction guaranteed total $\Delta n \leq 10 \bullet 10^{-6}$; with power subtracted Δn (p.s.) $\leq 6 \bullet 10^{-6}$;

(No special limits on size and weight).

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

INFRASIL 301 and 302 :		≤ 5 nm/cm across 80% of diameter or side length ≤ 5...15 nm/cm in the rim area.
INFRASIL 303	:	≤ 10 nm/cm across 80% of diameter ≤ 10...20 nm/cm in the rim area.

2.5 Spectral Transmittance

2.5.1 Typical transmission curves (including Fresnel reflection losses) for a 10 mm path length are shown in the figure.

2.5.2 Infrared Absorption

Very weak absorption bands occur at wavelengths around 1.39 μm, 2.2 μm, and 2.72 μm according to an OH content of ≤ 8 ppm (weight).

2.6 Fluorescence

Blue-violet with 254 nm excitation (low pressure Hg lamp and Schott UG 5 filter) and visual inspection.

2.7 Radiation Resistance

Good, visible transmittance is not degraded significantly by ionizing radiation.