Heraeus

HOMOSIL®, HERASIL® 1, 2 and 3

1. GENERAL PRODUCT DESCRIPTION

Heraeus HOMOSIL, HERASIL 1, 2, and 3 are optical quartz glass grades manufactured by flame fusion of natural quartz crystals. They combine excellent physical properties with outstanding optical characteristics in the 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

HOMOSIL and all HERASIL grades show a low bubble and inclusion content. HOMOSIL and HERASIL 1 meet the requirements for bubble class 0.

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

- HOMOSIL 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.

- HERASIL 1 and 2 are homogeneous in the primary functional direction. Weak striations, if any, are parallel to the major faces and do not affect the optical performance.
  HERASIL 1 and 2 are the preferred materials for demanding optics in one directional use such as lenses, UV-laser windows, optical flats, etc.

- HERASIL 3 can have weak striations through the functional direction.
  It is designed for commercial optical applications such as substrates, lightguide elements, beam delivery elements, microscope slides and UV-windows

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

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2. OPTICAL DATA OF HOMOSIL, HERASIL 1, 2 and 3

2.1 Bubbles and Inclusions

(Bubbles and inclusions ≤ 0.08 mm diameter are disregarded)

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

HOMOSIL	:	0	i.e. total bubble cross section within the volume is ≤ 0.03 mm²/100 cm³
HERASIL 1	:	0	i.e. total bubble cross section within the volume is ≤ 0.03 mm²/100 cm³
HERASIL 2	:	0....1	i.e. total bubble cross section within the volume is ≤ 0.10 mm²/100 cm³
HERASIL 3	:	2....3	i.e. total bubble cross section within the volume is ≤ 0.40 mm²/100 cm³

2.1.2 Maximum bubble diameter

HOMOSIL	:	≤ 0.10 mm	for pieces ≤ 6 kg
HERASIL 1	:	≤ 0.20 mm ≤ 0.50 mm	for pieces ≤ 6 kg for pieces > 6 - 30 kg
HERASIL 2	:	≤ 0.30 mm ≤ 0.60 mm	for pieces ≤ 6 kg for pieces > 6 - 30 kg
HERASIL 3	:	≤ 0.50 mm ≤ 1,00 mm	for pieces ≤ 6 kg for pieces > 6 - 30 kg

2.1.3 Inclusions

HOMOSIL, HERASIL 1 and 2	:	None	
HERASIL 3	:	≤ 0.20 mm²	sum of the cross sectional area within a piece, normalized to a volume of 100 cm^3

2.1.4 Spots : None

2.1.1 and 2.1.3 should not be added together

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

$n_F - n_C = 0.00678$

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

2.3 Optical Homogeneity

2.3.1 Granular Structure: None

2.3.2 Striations

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

HERASIL 1 and 2 : 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.

HERASIL 3 : Can have weak striations in the functional direction

2.3.3 Index Homogeneity

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

HOMOSIL : In all three dimensions guaranteed total $\Delta n \leq 3 \bullet 10^{-6}$; with power subtracted Δn (p.s.) $\leq 2 \bullet 10^{-6}$; on special request total $\Delta n \leq 1 \bullet 10^{-6}$.

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

2.3.3 Index Homogeneity (continued)

HERASIL 1 : In primary functional direction guaranteed total $\Delta n \leq 4 \bullet 10^{-6}$; with power subtracted Δn (p.s.) $\leq 2 \bullet 10^{-6}$; on special request total $\Delta n \leq 1 \bullet 10^{-6}$.

(No special limits on size and weight).

HERASIL 2 : In primary functional direction guaranteed total $\Delta n \leq 6 \bullet 10^{-6}$; with power subtracted Δn (p.s.) $\leq 3 \bullet 10^{-6}$;

(No special limits on size and weight).

HERASIL 3 : In primary functional direction guaranteed total $\Delta n \leq 10 \bullet 10^{-6}$; with power subtracted not specified.

(No special limits on size and weight).

□n (p.s.) (power subtracted) is calculated by subtracting from a measured □n 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

HOMOSIL,
HERASIL 1 and 2 : ≤ 5 nm/cm across 80% of diameter or side length
≤ 5...15 nm/cm in the rim area.

HERASIL 3 : ≤ 10 nm/cm across 80% of diameter
≤ 10...15 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

OH absorption bands occur at wavelengths around 1.39 μm, 2.2 μm, and 2.72 μm according to an OH content of approximately 150 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.