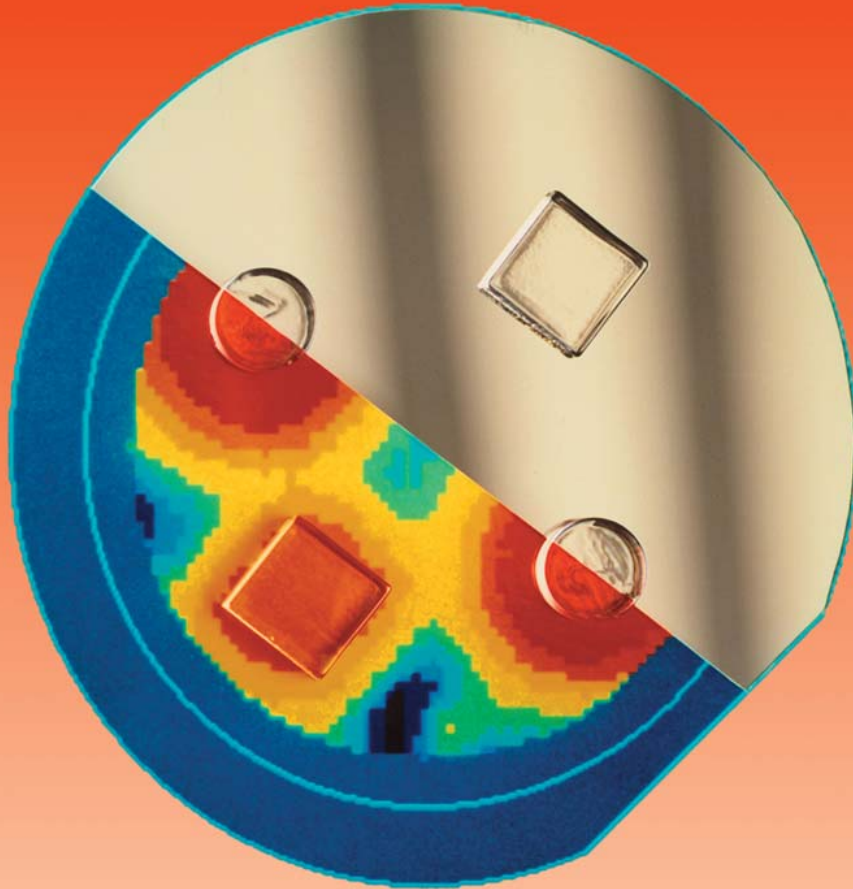


Heraeus



HSQ 351 / HSQ 751
Flame Fused
Quartz Glass

Heraeus Quarzglas

HSQ 351 / HSQ 751

Flame Fused Quartz Glass

General Product Description

Heraeus chemist Richard K uch first began fusing quartz rock crystal in an hydrogen/oxygen flame more than 100 years ago. Heraeus has been producing quartz glass on an industrial scale with this process ever since.

Flame fused quartz contains a significant amount of hydroxyl (OH) as a result of the direct contact between the H₂/O₂-flame and quartz grain. This OH content cannot be reduced by annealing and its presence lowers viscosity and infrared transmission.

However, the fact that the fusion atmosphere is oxidizing has a favorable effect on the diffusion of heavy metal impurities even though the amount of such contaminants present is very small. In particular, the ability of iron to migrate out of the quartz glass seems to be inhibited by the oxidizing conditions. This can have desirable effects for semiconductor manufacturing or other processes where a high sensitivity to heavy metals exists. In addition, flame fused quartz is free of larger bubbles.

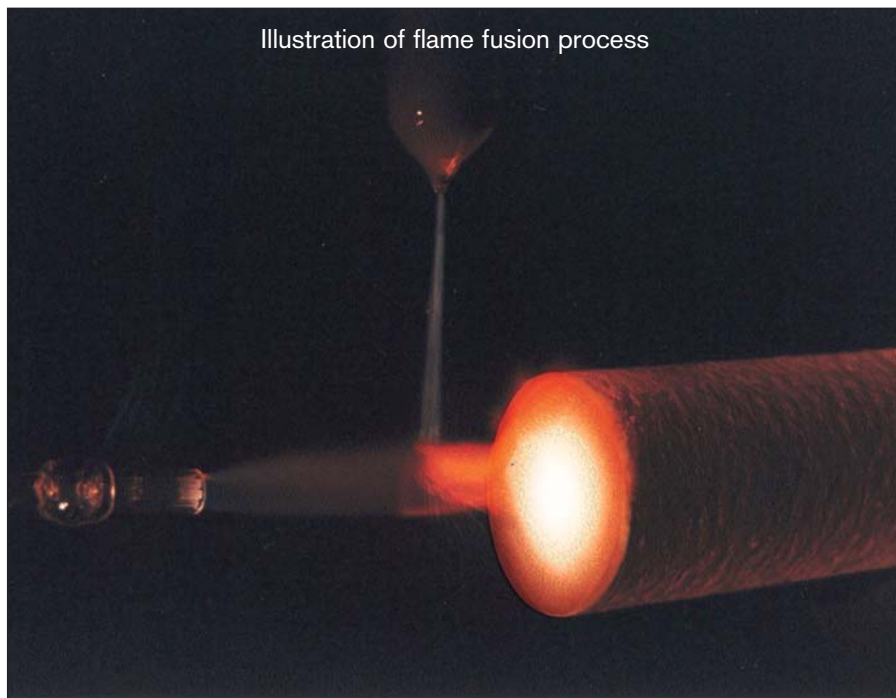


Illustration of flame fusion process

Process

The basic process consists of trickling high purity quartz sand at a controlled rate into a hydrogen / oxygen flame. There it melts and collects on a bait rod that is slowly withdrawn from the flame thus forming a solid round ingot (see picture above) that can be further shaped into any dimension.

Product Range

Heraeus Quarzglas offers two varieties of flame fused material: HSQ 351 and HSQ 751. Which material is best depends on the thermal properties and chemical purity required, which in turn depend on the final application.

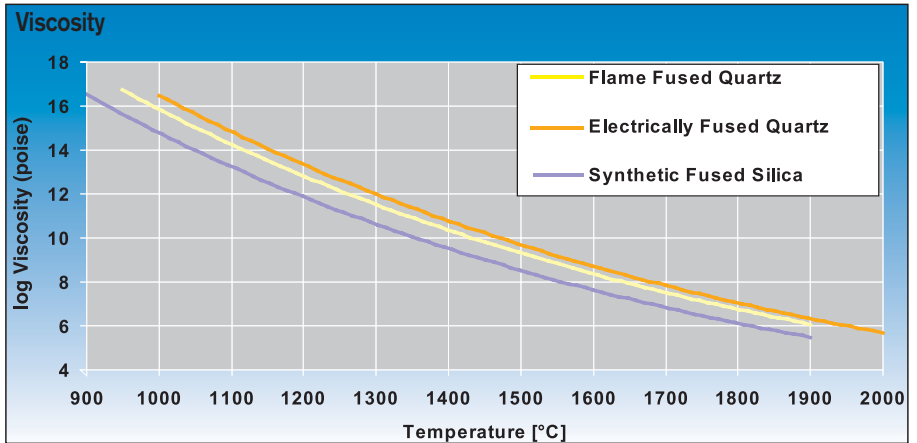
HSQ 351 offers exceptional material purity good for most semiconductor applications. However HSQ 751 offers significantly lower aluminum, alkali and heavy metal impurities for more demanding applications. Both are available as rods, tubes, plates, ingots, flanges and blocks.

Chemical Purity

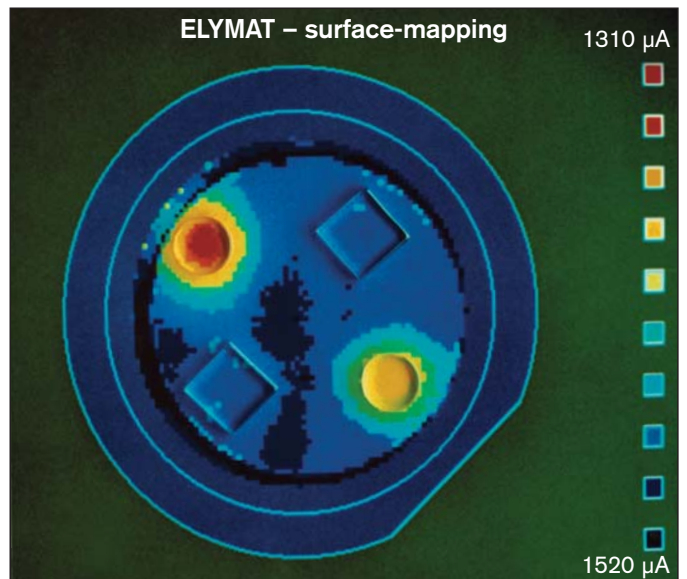
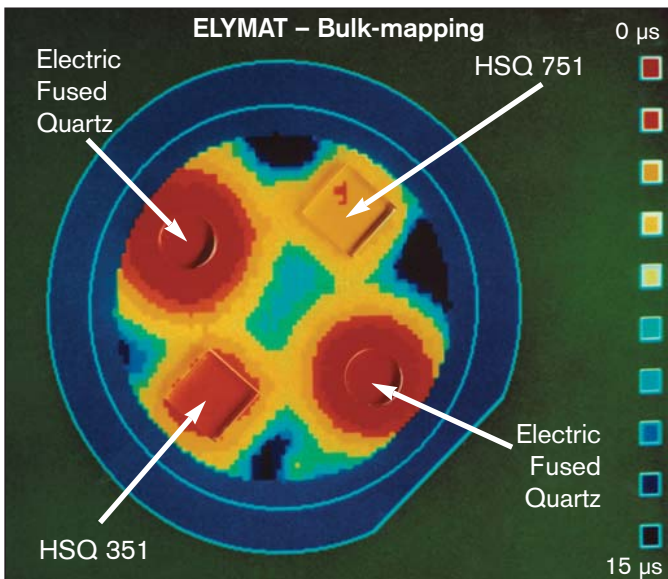
Typical Trace Elements and OH Content in Flame Fused Quartz Glass (ppm by weight oxide)

Elements	Al	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ti	Zr	OH Content
HSQ 351	15	0.6	< 0.05	0.07	0.2	0.7	0.4	0.1	0.05	0.8	1.1	1.1	175
HSQ 751	8	0.5	< 0.05	< 0.06	0.2	< 0.1	0.2	< 0.05	0.05	< 0.05	1.4	0.1	175

Tubes	Ø 2 – 1000 mm wall thickness 0.5 – 14 mm
Rods	Ø 2 – 100 mm
Ingots	Ø 100 – 650 mm
Plates	up to 500 x 500 mm
Blocks	up to 500 x 500 x 320 mm or up to 1500 x 320 x 145 mm
Discs	up to Ø 650 mm
Flanges	up to Ø 600 mm (OD)



Quartz glass used for thermal processing can influence silicon wafers. Studies involving wafers in direct contact with quartz glass gave the following results:



The use of HSQ 351 and HSQ 751 materials preserves the minority carrier lifetime in silicon wafers. Heavy metals are known to cause a variety of bulk and near-surface defects in silicon, causing device performance degradation and yield losses ^{(1) / (2)}.

Thermal process data:
1200°C, 120 min, N2 = 8SLM

Bulk results:

- Significant lifetime degradation and lateral influence from electrically fused samples
- Low influence from HSQ 351 and HSQ 751
- Results showed greatly reduced heavy metal content in silicon wafer using HSQ 351 / HSQ 751 instead of electrically fused quartz.

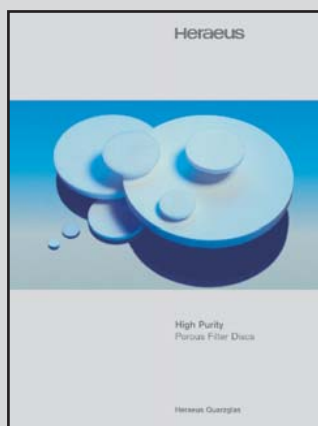
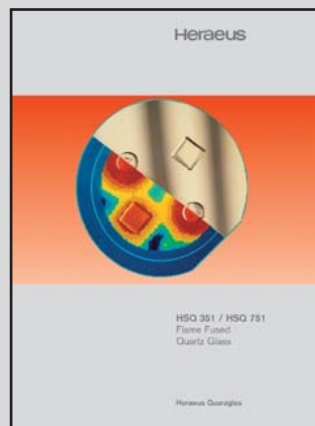
Surface results:

- Significant influence (photo current reduction) from electrically fused material
- Low influence from HSQ 351 and HSQ 751 samples.

(1) Metal Contamination in ULSI Technology
W. Bergholz, G. Zoth, F. Gelsdorf and B.O. Kolbesen: Defects in Silicon II, W. M. Bullins, F. Shiwura and U. Gösele eds., The Electrochem. Soc. Pennington NJ, 1991, p.21
(2) Imaging of Heavy Metal Contamination in Silicon Wafers for the Evaluation of Process Tools.
P. Eichinger, GeMeTec, STEP Europe Conference on Ultraclean Processing, Brussels, Oct. 90, p. 122

HSQ 351 / HSQ 751

Flame Fused Quartz Glass



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