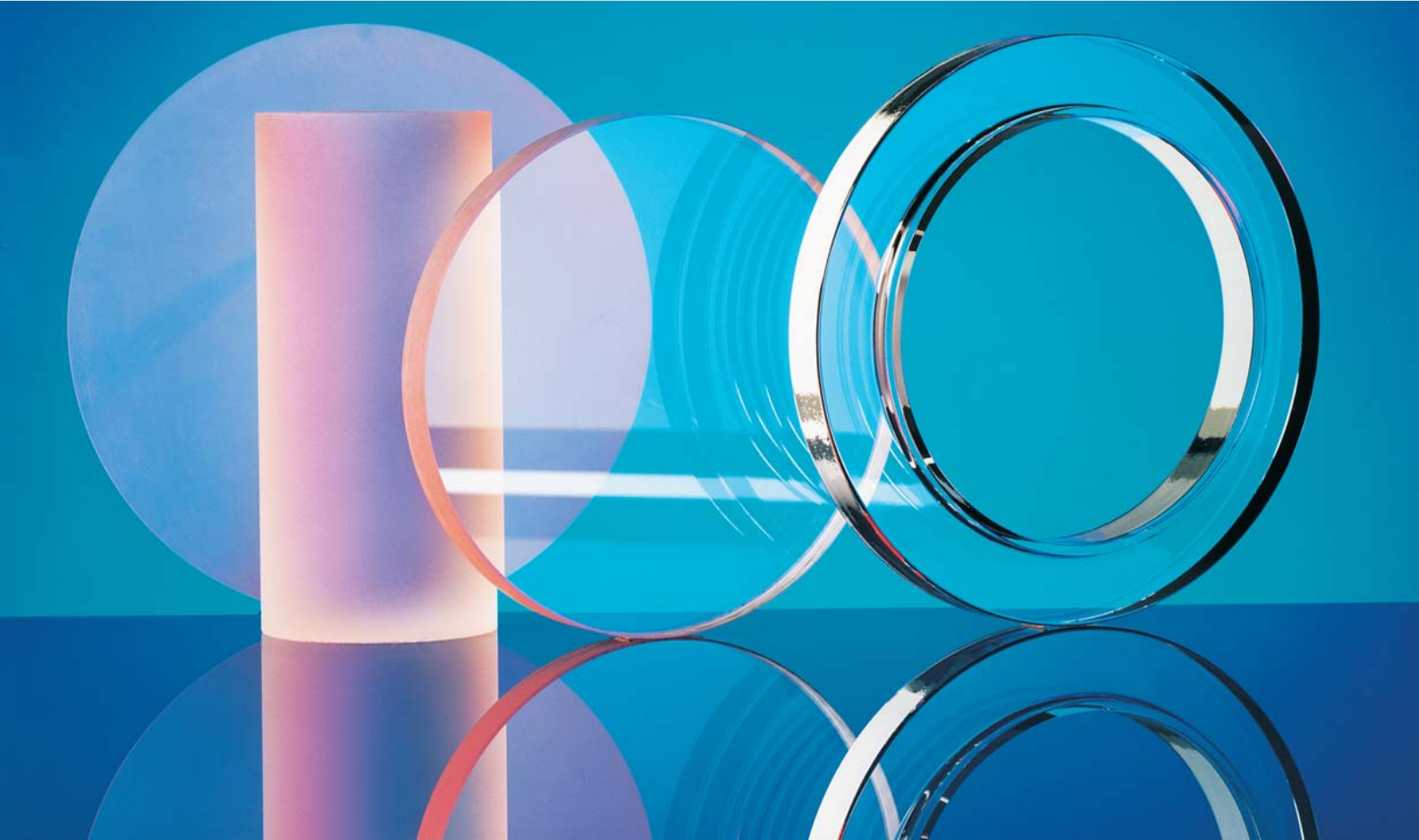


Heraeus



CFQ 099 / HSQ 100
HSQ 300 / HSQ 700
Electrically Fused
Quartz Glass

Heraeus Quarzglas

CFQ 099 / HSQ 100 / HSQ 300 / HSQ 700

Electrically Fused Quartz Glass

General Product Description

The electrical fusion process uses resistance heating to melt highly refined quartz sand into semifinished quartz glass products. Electrically fused quartz glass is characterized by:

- High purity level
- Low bubble content
- High homogeneity
- Excellent thermal shock resistance
- High visible and IR transmission

The main attributes of electrically fused materials are the low OH (hydroxyl) content and reduced devitrification rates. The low hydroxyl content increases infrared transparency and viscosity. The higher viscosity results in an increased maximum use temperature as well as helping to inhibit devitrification. In addition to the higher viscosity, devitrification is also restrained by the neutral/reducing atmosphere used during melting. This causes the material to be slightly oxygen deficient which has an inhibiting effect on devitrification. The OH content of HSQ 100, HSQ 300 and HSQ 700 is below 30 ppm. This can be further reduced to below 5 ppm via heat treatment under the right conditions.

Electric fusion is the most commonly used melting process for manufacturing quartz glass. There are two methods of electric fusion: continuous and batch (boule) fusion.

Continuous Fusion

In the continuous method, quartz sand is poured into the top of a vertical melter that consists of a refractory metal crucible surrounded by electric heating elements. The interior of the crucible is maintained in a neutral or slightly reducing atmosphere that keeps the silica from reacting with the refractory metal. The melted material exits the bottom orifice of the crucible which is shaped to produce rods, tubes or other products of various dimensions.

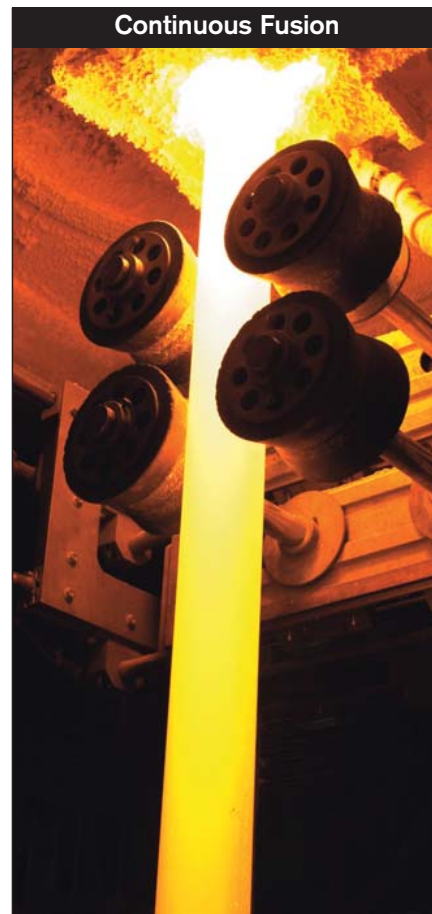
Batch Fusion

In the batch fusion method, several tons of raw material are placed inside a refractory lined vacuum chamber that also contains graphite heating elements. Although this method has historically been used to produce large single boules of materials, it can also be adapted to produce much smaller, near-net shapes.

Available sizes & forms

Tubes	Ø 2 – 1000 mm wall thickness 0.5 – 14 mm
Rods	Ø 2 – 100 mm
Ingots	Ø 100 – 1800 mm
Plates	up to 600 x 1800 mm
Blocks	up to 500 x 500 x 500 mm or up to 1500 x 320 x 145 mm
Discs	up to Ø 1800 mm
Flanges	up to Ø 600 mm (OD)

Available sizes depending on material grade



Heraeus offers a wide range of electrically fused quartz glass semifinished products. To meet new market requirements, different (often larger) sizes are always under development.

Chemical Purity

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

Elements	Al	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ti	Zr	OH Content
CFQ 099	15	0.8	< 0.05	< 0.1	0.4	0.8	1.2	0.1	0.1	0.9	1.5	0.8	n.s.*
HSQ 100	15	0.5	< 0.05	< 0.05	0.1	0.4	0.6	0.05	< 0.05	0.3	1.1	0.7	< 30 ¹⁾
HSQ 300	15	0.5	< 0.05	< 0.05	0.1	0.4	0.6	0.05	< 0.05	0.3	1.1	0.7	< 30
HSQ 700	15	0.5	< 0.05	< 0.05	0.1	0.1	0.05	0.05	< 0.05	0.05	1.1	0.7	< 30

*n.s.: not specified

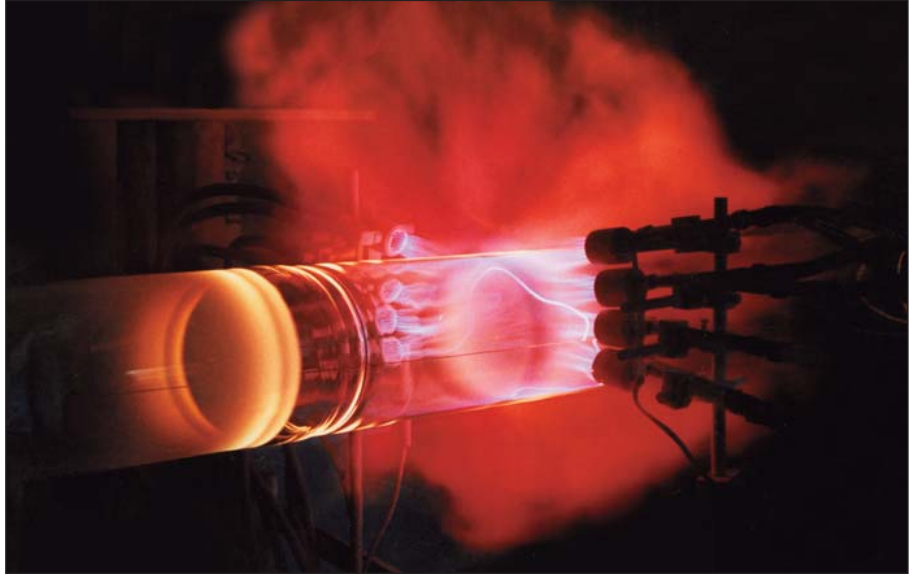
¹⁾ For HSQ 100 rods. OH content of other HSQ 100 semi-finished products on request.

Material Types

The Heraeus family of electrically fused materials offers a broad selection of quality materials so that the proper balance of economy and optimum properties can be achieved for any application. Purity is mostly determined by the extent of refinement of the raw material. Heraeus uses only very highly refined quartz sand coupled with rigorous quality control to make its products.

CFQ 099 is the standard purity grade electrically fused quartz for general applications. **HSQ 100** is single step drawn rod and tubing that has the same excellent properties as CFQ 099, but with higher purity.

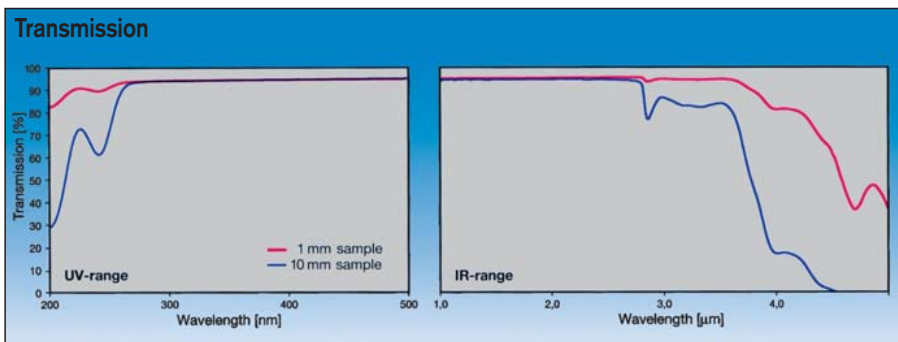
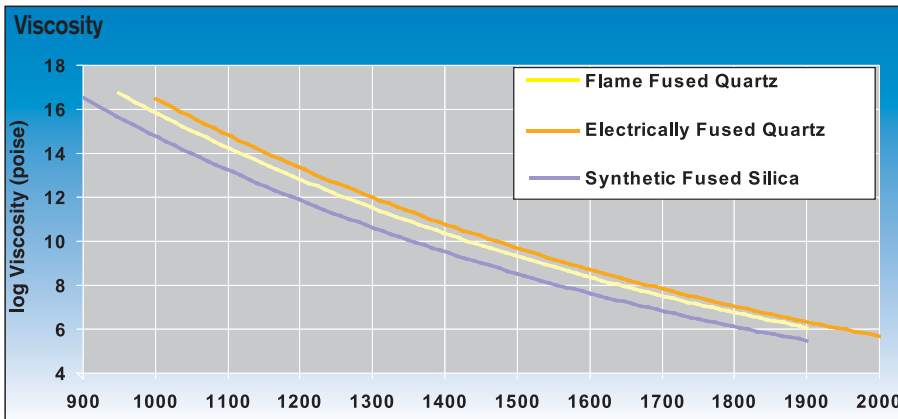
HSQ 300 is similar to HSQ 100 with purity values that often exceed the specifications for high purity materials set forth by major semiconductor OEM's.



However, additional production steps are used to reduce the bubble content and homogenize the material.

With total alkalis typically below 0.2 ppm **HSQ 700** offers an ultra-high material purity for particularly sensitive applications.

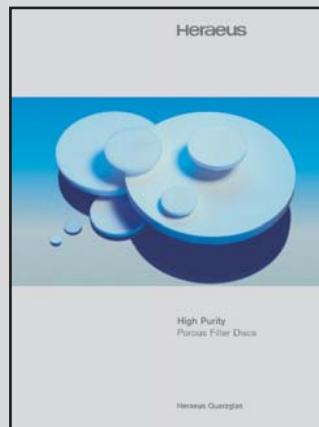
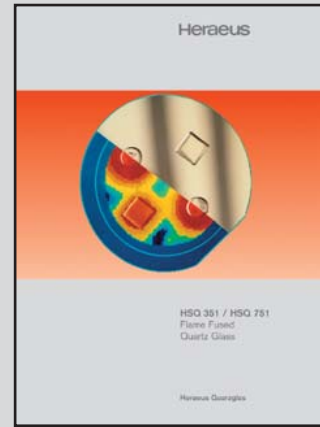
Ionic alkaline impurities that diffuse quickly like Na, Li and K can be removed by a special electrolysis process. This is done by passing an electric current through the glass at high temperature as shown in the picture above.



Density	2.203 g/cm ³
Modulus of elasticity (at 20°C)	7.25 x 10 ⁴ N/mm ²
Poisson's ratio	0.17
Compressive strength (approx.)	1150 N/mm ²
Tensile strength (approx.)	50 N/mm ²
Bending strength (approx.)	67 N/mm ²
Torsional strength (approx.)	30 N/mm ²
Softening temperature	1710°C
Annealing temperature	1220°C
Strain temperature	1125°C
Max. working temperature continuous short-term	1160°C 1300°C
Mean coefficient of thermal expansion	≈ 5.0 x 10 ⁻⁷ /°C

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Electrically Fused Quartz Glass



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