

TSC Series

Applications

Semiconductor, solar, LED and flat panel display applications.

Characteristics

High purity quartz solid and hollow material with low bubble content.

TSC Grades

TSC ingots are made with the highest quality natural quartz powders that have been refined using Heraeus' proprietary purification process.

These high purity powders are then fused using Heraeus' unique flame fusion technique resulting in material with low levels of alkali and very few bubbles and inclusions.

Specializing in "near-net-shape", TSC ingots are available in rectangular, round and hollow shapes and in a wide range of sizes. These near-net-shape ingots help to reduce costs in volume applications. Ingots can be cut and ground or lapped to make blanks in a variety of shapes including rectangular or square plates, discs and rings.



TSC-3® is the standard semiconductor grade material, ideal for use in single wafer processing applications such as plasma etch and deposition systems.

TSC-4 further reduces the risk of contamination by providing a lower Al and alkali content. TSC-4 has been designed for the most demanding semiconductor applications.

Available Dimensions

The TSC Series is readily available in large sizes of up to 670 x 2200 mm. Larger sizes are available on request, please check for availability.

Rectangular Ingots (Length up to 2200 mm)

Thickness (mm)	200			
	160			
	120			
Width (mm)	450	540	670	

Hollow Ingots

	mm
OD	Up to 670
OD tolerance	+4 / -0
Wall thickness	≥ 15

Round Ingots

Length (mm)	2300				
	1900				
	210				
	160				
	120				
Diameter (mm)	310	350	420	540	670

Chemical Purity – Typical trace elements and OH content in quartz glass (ppm by weight oxide)

Elements	Al	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ti	Zr	OH
TSC-3®	15	0.4	< 0.01	< 0.01	0.05	0.2	0.2	< 0.01	< 0.01	0.3	1.1	0.8	170
TSC-4	8	0.7	< 0.01	< 0.01	0.1	0.08	0.04	< 0.01	< 0.01	0.2	1.3	0.7	170

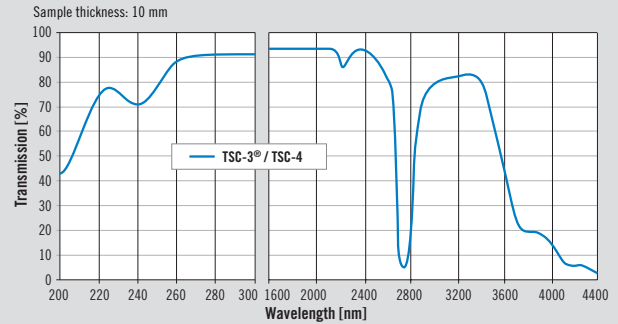
Bubbles and Inclusions

Heraeus' flame fusion process has been developed to ensure TSC materials have much fewer bubbles and inclusions than traditional electrically fused quartz.

Table showing typical combined bubble and inclusion counts per ft³

Grade	Bubble & Inclusion Diameter (mm)			
	< 0.3	0.3 ~ 0.5	0.5 ~ 1.0	> 1.0
TSC-3® & TSC-4	Not Specified	7	0	0

Typical Transmission Spectrum (including Fresnel reflection losses)



Technical Properties TSC-3® / TSC-4

Mechanical Data

Density (g/cm ³)	2.2
Mohs Hardness	5.5 ... 6.5
Micro Hardness (N/mm ²)	8600 ... 9800
Knoop Hardness (N/mm ²)	5800 ... 6100
Modulus of elasticity at 20 °C (N/mm ²)	7.3 x 10 ⁴
Modulus of torsion (N/mm ²)	3.0 x 10 ⁴
Poisson's ratio	0.16
Compressive strength (approx.) (N/mm ²)	1110
Tensile strength (approx.) (N/mm ²)	50
Bending strength (approx.) (N/mm ²)	65
Torsional strength (approx.) (N/mm ²)	30
Sound velocity (m/s)	5700

Thermal Data

Softening temperature (°C)	1730
Annealing temperature (°C)	1200
Strain temperature (°C)	1080
Max. working temperature – continuous (°C)	1050
Max. working temperature – short term (°C)	1350

Mean specific heat (J/kg*K)

0 ... 100 °C	772
0 ... 500 °C	964
0 ... 900 °C	1052

Heat conductivity (W/m*K)

20 °C	1.38
100 °C	1.47
200 °C	1.55
300 °C	1.67
400 °C	1.84
950 °C	2.68

Mean expansion coefficient (K⁻¹)

0 ... 100 °C	5.1 x 10 ⁻⁷
0 ... 200 °C	5.8 x 10 ⁻⁷
0 ... 300 °C	5.9 x 10 ⁻⁷
0 ... 600 °C	5.4 x 10 ⁻⁷
0 ... 900 °C	4.8 x 10 ⁻⁷
-50 ... 0 °C	2.7 x 10 ⁻⁷

Electric Data TSC-3® / TSC-4

Electrical resistivity (Ω*m)

20 °C	10 ¹⁶
400 °C	10 ¹⁰
800 °C	6.3 x 10 ⁶
1200 °C	1.3 x 10 ³

Dielectric strength (kV/mm) [sample thickness ≥ 5 mm]

20 °C	25 ... 40
500 °C	4 ... 5

Dielectric loss angle (tg δ)

1 kHz	5.0 x 10 ⁻⁴
1 MHz	1.0 x 10 ⁻⁴
3 x 10 ¹⁰ Hz	4.0 x 10 ⁻⁴

Dielectric constant (ε)

20 °C 0 ... 10 ⁶ Hz	3.70
23 °C 9 ... 10 ⁶ Hz	3.77
23 °C 3 ... 10 ¹⁰ Hz	3.81

Europe

Heraeus Quarzglas GmbH & Co. KG
Base Materials Kleinostheim
Germany
Phone +49 (6181) 35-7444
sales.hqs.basematerials.de
@heraeus.com

Japan

Shin-Etsu Quartz Products Co., Ltd.
Tokyo 160-0023
Japan
Phone +81 (3) 3348 1913
division3@sqp.co.jp

UK

Heraeus Quartz UK Ltd.
WallSEND Tyne & Wear
NE28 6DD
UK
Phone +44 (191) 2598 411
sales.hqs.tsc.uk@heraeus.com

Korea

HS Advanced Materials Co., Ltd.
Chungbuk Province
Korea
Phone +82 (43) 532 5371
hsam@hsam.com

China

Heraeus ShinEtsu Quartz (China) Inc.
200122 Shanghai, China
Phone +86 (21) 68672266-809
sales.hqs.basematerials.cn
@heraeus.com

Taiwan

Heraeus Materials Technology Ltd.
Taipei
Taiwan
Phone +886 (2) 2627 1111
jamescp.pan@heraeus.com

USA

Heraeus Quartz America LLC
Base Materials Division Austin,
TX 78728, USA
Phone (+1) 512 989 05 03
sales.hqs.basematerials.us
@heraeus.com

www.base-materials.heraeus-quarzglas.com