

## TSC Series

### Applications

Viewing windows, wet bench tanks and semiconductor applications

### Characteristics

Flame fused quartz block and hollow material with low bubble content



**TSC-3®** fused quartz is produced in a flame fusion process from refined natural quartz powder. The production process ensures a low alkali content. The long furnace residence time guarantees a low bubble content, resulting in excellent visual properties.

**TSC-4** additionally offers a reduced aluminium content.

**TSC-Synthetic** has very high purity and is produced from synthetic fused silica powder. It has excellent visual quality with no bubbles larger than 0.1 mm. The high purity of TSC-Synthetic ensures excellent deep UV transmission. TSC-Synthetic is available in large sizes (up to 600 mm x 2000 mm).

Heraeus transparent ingots are available in rectangular, round and hollow shapes and a wide range of sizes. Ingots can be cut and ground or lapped to make blanks in a variety of shapes including rectangular or square plates, disks and rings.

### Available Dimensions

#### Rectangular Ingots (Length up to 2200 mm)

Thickness	200 mm			
	160 mm			
	120 mm			
Width	< 450 mm	< 540 mm	< 670 mm	

#### Hollow Ingots

	mm
OD	Up to 670
OD tolerance	+4 / -0
Wall Thickness	>= 15

#### Round Ingots

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

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

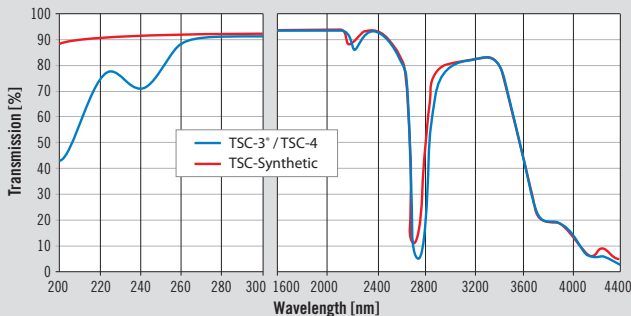
Elements	Al	Ca	Cr	Cu	Fe	K	Li	Mn	Na	Nd	Ti	Y	Zr	OH
TSC-3®	15	0.5	<0.01	<0.01	0.1	0.2	0.2	0.01	0.1	0.1	1.3	<0.1	1.3	170
TSC-4	8	0.4	<0.01	<0.01	0.2	0.05	0.2	<0.01	<0.08	<0.1	1.5	<0.01	0.5	170
TSC-Synthetic	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.15	0.01	0.01	0.02	130

## Technical Properties

	TSC-3®	TSC-4	TSC-Synthetic
<b>Mechanical Data</b>			
Density (g/cm <sup>3</sup> )	2,2	2,2	2,2
Mohs Hardness	5.5 ... 6.5	5.5 ... 6.5	5.5 ... 6.5
Micro Hardness (N/mm <sup>2</sup> )	8600 ... 9800	8600 ... 9800	8600 ... 9800
Knoop Hardness (N/mm <sup>2</sup> )	5800 ... 6100	5800 ... 6100	5800 ... 6100
Modulus of elasticity at 20°C (N/mm <sup>2</sup> )	7.3 x 10 <sup>4</sup>	7.3 x 10 <sup>4</sup>	7.3 x 10 <sup>4</sup>
Modulus of torsion (N/mm <sup>2</sup> )	3.0 x 10 <sup>4</sup>	3.0 x 10 <sup>4</sup>	3.0 x 10 <sup>4</sup>
Poisson's ratio	0.16	0.16	0.16
Compressive strength (approx.) (N/mm <sup>2</sup> )	1110	1110	1110
Tensile strength (approx.) (N/mm <sup>2</sup> )	50	50	50
Bending strength (approx.) (N/mm <sup>2</sup> )	65	65	65
Torsional strength (approx.) (N/mm <sup>2</sup> )	30	30	30
Sound velocity (m/s)	5700	5700	5700
<b>Thermal Data</b>			
Softening temperature (°C)	1730	1730	1730
Annealing temperature (°C)	1200	1200	1200
Strain temperature (°C)	1080	1080	1080
Max. working temperature continuous (°C)	1050	1050	1050
Short-term (°C)	1350	1350	1350

## Typical Transmission Spectrum (including Fresnel reflection losses)

Sample thickness: 10 mm



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	TSC-3®	TSC-4	TSC-Synthetic
<b>Mean specific heat (J/kg*K)</b>			
0 ... 100°C	772	772	772
0 ... 500°C	964	964	964
0 ... 900°C	1052	1052	1052
<b>Heat conductivity (W/m*K)</b>			
20°C	1.38	1.38	1.38
100°C	1.47	1.47	1.47
200°C	1.55	1.55	1.55
300°C	1.67	1.67	1.67
400°C	1.84	1.84	1.84
950°C	2.68	2.68	2.68
<b>Mean expansion coefficient (K<sup>-1</sup>)</b>			
0 ... 100°C	5.1 x 10 <sup>-7</sup>	5.1 x 10 <sup>-7</sup>	5.1 x 10 <sup>-7</sup>
0 ... 200°C	5.8 x 10 <sup>-7</sup>	5.8 x 10 <sup>-7</sup>	5.8 x 10 <sup>-7</sup>
0 ... 300°C	5.9 x 10 <sup>-7</sup>	5.9 x 10 <sup>-7</sup>	5.9 x 10 <sup>-7</sup>
0 ... 600°C	5.4 x 10 <sup>-7</sup>	5.4 x 10 <sup>-7</sup>	5.4 x 10 <sup>-7</sup>
0 ... 900°C	4.8 x 10 <sup>-7</sup>	4.8 x 10 <sup>-7</sup>	4.8 x 10 <sup>-7</sup>
-50 ... 0°C	2.7 x 10 <sup>-7</sup>	2.7 x 10 <sup>-7</sup>	2.7 x 10 <sup>-7</sup>

## Electric Data

	TSC-3®	TSC-4	TSC-Synthetic
<b>Electrical resistivity in Ω x m</b>			
20°C	10 <sup>16</sup>	10 <sup>16</sup>	10 <sup>16</sup>
400°C	10 <sup>10</sup>	10 <sup>10</sup>	10 <sup>10</sup>
800°C	6.3 x 10 <sup>6</sup>	6.3 x 10 <sup>6</sup>	6.3 x 10 <sup>6</sup>
1200°C	51.3 x 10 <sup>5</sup>	51.3 x 10 <sup>5</sup>	51.3 x 10 <sup>5</sup>
<b>Dielectric strength in KV/mm (sample thickness ≥ 5 mm)</b>			
20°C	25 ... 40	25 ... 40	25 ... 40
500°C	4 ... 5	4 ... 5	4 ... 5
<b>Dielectric loss angle (tg δ)</b>			
1kHz	5.0 x 10 <sup>-4</sup>	5.0 x 10 <sup>-4</sup>	5.0 x 10 <sup>-4</sup>
1MHz	1.0 x 10 <sup>-4</sup>	1.0 x 10 <sup>-4</sup>	1.0 x 10 <sup>-4</sup>
3 x 10 <sup>10</sup> Hz	4.0 x 10 <sup>-4</sup>	4.0 x 10 <sup>-4</sup>	4.0 x 10 <sup>-4</sup>
<b>Dielectric constant (ε)</b>			
20°C 0 ... 10 <sup>6</sup> Hz	3.70	3.70	3.70
23°C 9 ... 10 <sup>8</sup> Hz	3.77	3.77	3.77
23°C 3 ... 10 <sup>10</sup> Hz	3.81	3.81	3.81

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