

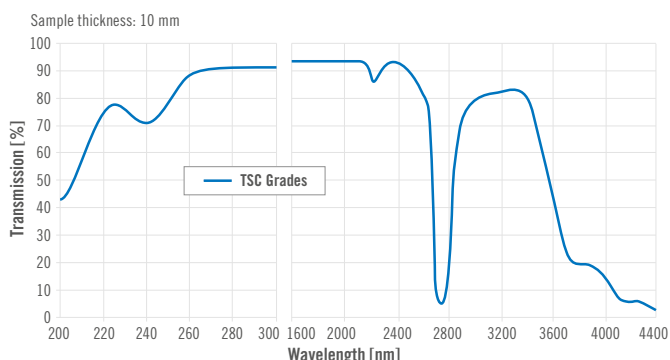
Bubbles and Inclusions

Heraeus' flame fusion process has been developed to ensure TSC materials have the lowest amount of bubbles and inclusion available in fused quartz materials.

Typical combined bubble and inclusion counts per 100 cm³

Diameter [mm]	TSC-3N	TSC-3®	TSC-4	TSC-T
< 0.1	n. sp.	n. sp.	n. sp.	n. sp.
0.1 - 0.2	< 5	< 5	< 5	0
0.2 - 0.5	< 0.1	< 0.1	< 0.1	0
0.5 - 1	0	0	0	0
> 1	0	0	0	0

Typical Transmission Spectrum (including Fresnel reflection losses)



Technical Properties TSC Grades

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 × 10 ⁴
Modulus of torsion [N/mm ²]	3.0 × 10 ⁴
Poisson's ratio	0.16
Compressive strength [N/mm ²]	~ 1110
Tensile strength [N/mm ²]	~ 50
Bending strength [N/mm ²]	~ 65
Torsional strength [N/mm ²]	~ 30
Sound velocity [m/s]	5700

Thermal Data

	flame fused	synthetic
Softening temperature [°C]	1660	1600
Annealing temperature [°C]	1160	1100
Strain temperature [°C]	1070	1000
Max. working temp. [°C] continuous	1110	950
Max. working temp. [°C] short term	1250	1200

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

Electrical Data TSC Grades

Electrical resistivity [Ω*m]

20 °C	10 ¹⁶
400 °C	10 ¹⁰
800 °C	6.3 × 10 ⁶
1200 °C	1.3 × 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 × 10 ⁻⁴
1 MHz	1.0 × 10 ⁻⁴
3 × 10 ¹⁰ Hz	4.0 × 10 ⁻⁴

Dielectric constant (ε)

20 °C	0 ... 10 ⁶ Hz	3.70
23 °C	9 ... 10 ⁸ Hz	3.77
23 °C	3 ... 10 ¹⁰ Hz	3.81

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