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VACUUM & MATERIALS

TDS

SiO_2 FUSED SILICA SUBSTRATES

Fused silica is a widely used material with high chemical purity, good thermal characteristics and excellent homogeneity. Very good thermal expansion characteristic is an outstanding feature of fused silica. Fused silica is primarly used in wider thermal application. Fused silica includes UV grade and IR grade.

- Typical index Homogeneity : < 8×10^{-6}
- Thermal Expansion coefficient : 0.58×10^{-6}/K (0°C to 200°C)
- Density : 2.201 g/cm^3

There are mainly three types of fused silica, NEGS1, NEGS2, NEGS3, they are used for different applications. Please refer to the table below for details.

Properties			
	NEGS1	**NEGS2**	**NEGS3**
Maximum size	< Ø 200 mm	< Ø 300 mm	< Ø 200 mm
Transmission range (Medium transmission ratio)	0.17~2.10µm (Tavg >90%)	0.26~2.10µm (Tavg >85%)	0.185~3.50µm (Tavg >85%)
OH-Content	1200 ppm	150 ppm	5 ppm
Fluorescence (ex 254 nm)	Virtually free	Strong v-b	Strong V-B
Impurity Content	5 ppm	20-40 ppm	40-50 ppm
Birefringence Constant	2-4 nm/cm	4-6 nm/cm	4-10 nm/cm
Melting method	Synthetic CVD	Oxy-hydrogen melting	Electrical melting
Applications	Laser substrate : window, lens, prism, mirror..	Semiconductor and high temperature	IR & UV substrate

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30 avenue de la Paix - 92170 VANVES - FRANCE
Tel: 33(0)1.41.90.50.50 / Fax: 33(0)1.41.90.50.51

NEGS1 is mainly used for optics operating in the UV and the visible wavelenght range. It is free of bubbles and inclusions. It is equivalent to Suprasil 1 & 2 and Corning 7980.

NEGS2 is mainly used as mirror substrate, as it has tiny bubbles inside. It is equivalent to Homosil 1, 2 & 3.

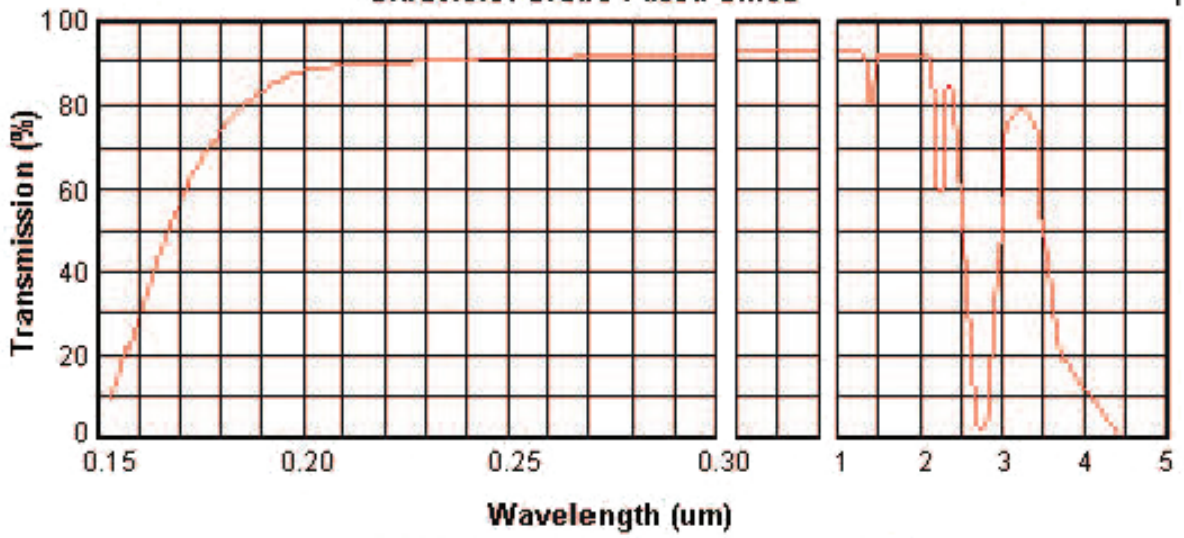
NEGS3 is transparent in the ultraviolet, visible and infrared spectral regions, but it has many bubbles inside. It is equivalent to Suprasil 300.

Density		**2.20 g/cm^3**	
Abbe Constant		**67.6**	
Refractive Index (nd) at 588 nm		**1.4586**	
Wavelenght (µm)	**Refractive index**	**Wavelenght (µm)**	**Refractive index**
0.200	1.55051	1.000	1.45042
0.220	1.52845	1.064	1.44962
0.250	1.50745	1.100	1.44920
0.300	1.48779	1.200	1.44805
0.320	1.48274	1.300	1.44692
0.360	1.47529	1.500	1.44462
0.400	1.47012	1.600	1.44342
0.450	1.46557	1.700	1.44217
0.488	1.46302	1.800	1.44087
0.500	1.46233	1.900	1.43951
0.550	1.46008	2.000	1.43809
0.588	1.45860	2.200	1.43501
0.600	1.45804	2.400	1.43163
0.633	1.45702	2.600	1.42789
0.650	1.45653	2.800	1.42377
0.700	1.45529	3.000	1.41925
0.750	1.45424	3.200	1.41427
0.800	1.45332	3.370	1.40990
0.850	1.45250	3.507	1.40566
0.900	1.45175	3.707	1.39936

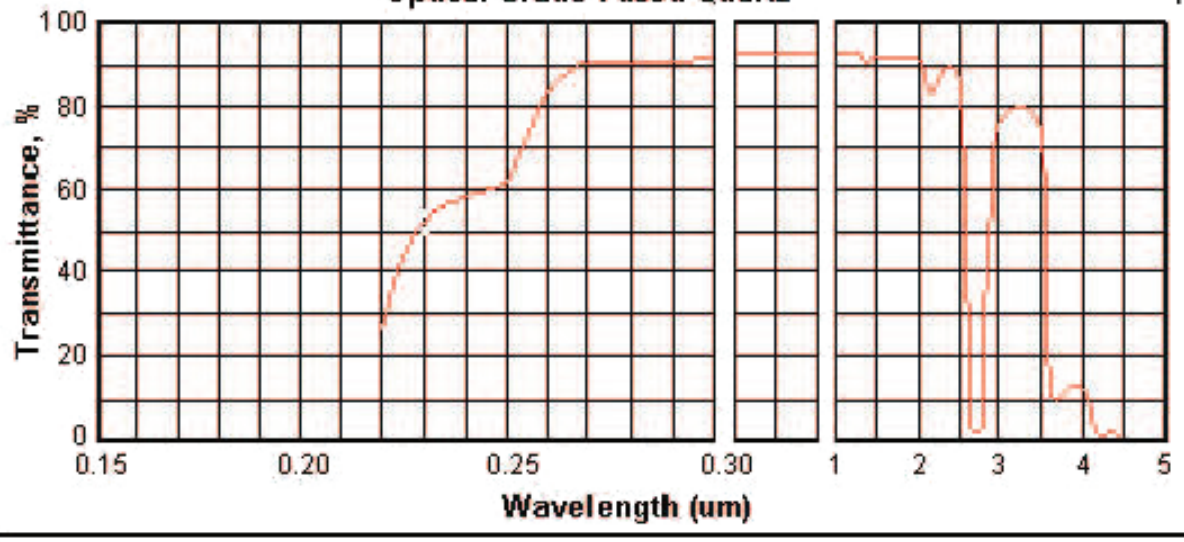
Hardness	5.5 - 6.5 Mohs' Scale 570 KHN 100
Design Tensile Strenght	4.8×10^7 Pa (N/mm^2) (7000 psi)
Design Compressive Strenght	Greater than 1.1 x 109 Pa (160,000 psi)
Bulk Modulus	3.7×10^{10} Pa (5.3×10^6 psi)
Rigidity Modulus	3.1×10^{10} Pa (4.5×10^6 psi)
Young's Modulus	7.2×10^{-10} Pa (10.5×10^6 psi)
Poisson's Ratio	0.17
Coefficient of Thermal Expansion	5.5×10^7 cm/cm.°C (20°C-320°C)
Thermal Conductivity	1.4 W/m.°C
Specific Heat	670 J/kg.°C
Softening Point	1683 °C
Annealing Point	1215 °C
Strain Point	1120 °C
Electrical Receptivity	7×10^7 ohm.cm (350 °C)
Dielectric Properties (20 °C and 1 MHz) **Constant** **Strenght Loss** **Loss Factor** **Factor Dissipation**	 3.75 5.10^7 V/m Less than 4×10^{-4} Less than 1×10^{-4}
Velocity of Sound-Shear Wave	3.75×10^3 m/s
Velocity of Sound/Compression Wave	5.90×10^3 m/s
Sonic Attenuation	Less than 11 db/m MHz
Permeability Constants (cm^3mm/cm^2sec cm of Hg) **Helium** **Hydrogen** **Deuterium** **Neon**	(700 °C) 210×10^{-10} 21×10^{-10} 17×10^{-10} 9.5×10^{-17}
Chemical stability (except hydrofluoric)	High resistance to water and acids

Transmission Curve	See below

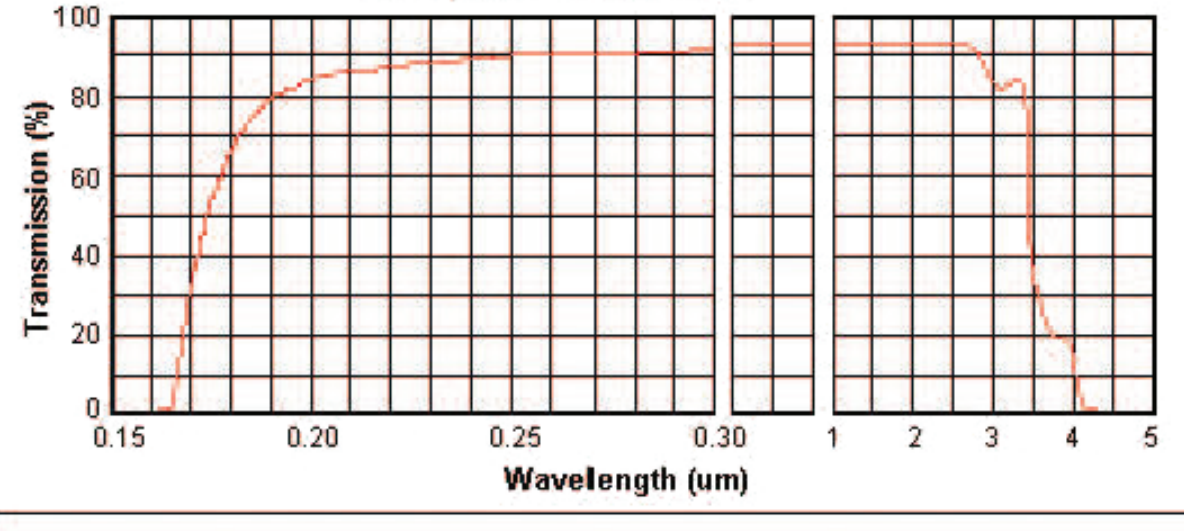
Ultraviolet Grade Fused Silica — NEGS1



Optical Grade Fused Quartz — NEGS2



Full Spectrum Fused Silica — NEGS3



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