

Quartz Crystal (SiO₂)



APPLICATIONS: Optically, Crystalline Quartz is used extensively as a wave retardation medium. The birefringent properties of Quartz are of use in quarter-wave plates and in polarisers. Quartz should not be processed or used at temperatures greater than 490°C.

Transmission Range	0.18 to 3.5µm (also >40µm)
Refractive Index	No 1.54421; Ne 1.55333 at 0.6µm
Reflection Loss	8.8% at 0.6µm (2 surfaces)
Absorption Coefficient	n/a
Reststrahlen Peak	n/a
dn/dT (3) (4)	-5.5 x 10 ⁻⁶ /°K (para) & -6.5 x 10 ⁻⁶ /°K (perp) @ 633nm
dn/dµ = 0	1.3µm

Density	2.649 g/cc
Melting Point	1710 °C
Thermal Conductivity	10.7 (para) 6.2 (perp) W m ⁻¹ K ⁻¹ at 323 K
Thermal Expansion	7.1 (para) 13.2 (perp) x 10 ⁻⁶ /°C
Hardness	Knoop 741 with 500g indenter
Specific Heat Capacity	710 J Kg ⁻¹ K ⁻¹
Dielectric Constant	4.34 (para) 4.27 (perp) at 30MHz
Youngs Modulus (E)	97.2 (para) 76.5 (perp) GPa
Shear Modulus (G)	31.14 GPa
Bulk Modulus (K)	36.4 GPa
Elastic Coefficients (1) (2)	C ₁₁ =87 C ₁₂ =7 C ₄₄ =58 C ₁₃ =13 C ₁₄ =(-)18 C ₃₃ =106
Apparent Elastic Limit	41MPa (5950psi)
Poisson Ratio	n/a

Solubility	Insoluble in water
Molecular Weight	60.06
Class/Structure	Trigonal (hex) P3(2)21 (RH) and P3(1)21 (LH)

Quartz is mined naturally, but more commonly produced synthetically in large, long-faceted crystals. Quartz is positive birefringent. Be careful not to confuse terminology in this material, as "Fused Quartz" is often used to denote the glassy non-crystalline form better known as Silica. Normal Quartz is Alpha Quartz and normally RH rotating. LH rotating is available on special order. At temperatures >490°C, Crystal Quartz starts to revert to glassy state, a process which is complete by 530°C. At this time, as annealing is unlikely, fracture of component is probable.

REFERENCES:

- (1) J.V. Atansoff and P.J. Hart, Phys. Rev. Vol.59, pp 85-96 1941
- (2) A.W. Lawson, Phys. Rev. Vol 59, pp.838-839, 1941
- (3) F.J. Micheli, Ann. Physik 4:7 (1902)
- (4) Toyoda & Yabe J. Phys. D: Appl. Phys., 16 (1983)

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µm	No	Ne	µm	No	Ne
0.193	1.661	1.675	0.213	1.632	1.645
0.222	1.622	1.634	0.226	1.619	1.630
0.248	1.602	1.613	0.257	1.596	1.607
0.280	1.585	1.596	0.308	1.576	1.586
0.325	1.571	1.581	0.351	1.565	1.575
0.400	1.558	1.567	0.458	1.552	1.561
0.488	1.550	1.559	0.515	1.548	1.557
0.532	1.547	1.556	0.590	1.544	1.553
0.633	1.543	1.552	0.670	1.541	1.551
0.694	1.541	1.550	0.755	1.539	1.548
0.780	1.539	1.548	0.800	1.538	1.547
0.820	1.538	1.547	0.860	1.537	1.547
0.980	1.535	1.546	1.064	1.534	1.543
1.320	1.531	1.539	1.550	1.528	1.536
2.010	1.521	1.529			

