Silicon (Si)

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APPLICATIONS: Silicon is used as an optical window primarily in the 3 to 5 micron band and as a substrate for production of optical filters. Large blocks of Silicon with polished faces are also employed as neutron targets in Physics experiments

Transmission Range
Refractive Index
Reflection Loss
Absorption Coefficient
Reststrahlen Peak
dn/dT
$dn/d\mu = 0$
·

1.2 to 15μm (1) 3.4223 @ 5μm (1) (2) 46.2% at 5μm (2 surfaces) 0.01 cm⁻¹ at 3μm n/a 160 x 10⁻⁶ /°C (3) 10.4μm

Density Melting Point Thermal Conductivity Thermal Expansion Hardness Specific Heat Capacity Dielectric Constant Youngs Modulus (E) Shear Modulus (G) Bulk Modulus (K) Elastic Coefficients Apparent Elastic Limit Poisson Ratio 2.33 g/cc 1420 °C 163.3 W m⁻¹ K⁻¹ at 273 K 2.6 x 10⁻⁶ / K at 20°C Knoop 1150 703 J Kg⁻¹ K⁻¹ 13 at 10 GHz 131 GPa (4) 79.9 GPa (4) 102 GPa C₁₁=167; C₁₂=65; C₄₄=80 (4) 124.1MPa (18000 psi) 0.266 (4)

SolubilityInsoluble in WaterMolecular Weight28.09Class/StructureCubic diamond, Fd3m

Silicon is grown by Czochralski pulling techniques (CZ) and contains some oxygen which causes an absorption band at $9\mu m$. To avoid this, Silicon can be prepared by a Float-Zone (FZ) process. Optical Silicon is generally lightly doped (5 to 40 ohm cm) for best transmission above $10\mu m$. Silicon has a further pass band 30 to $100\mu m$ which is effective only in very high resistivity uncompensated material. Doping is usually Boron (p-type) and Phosphorus (n-type).

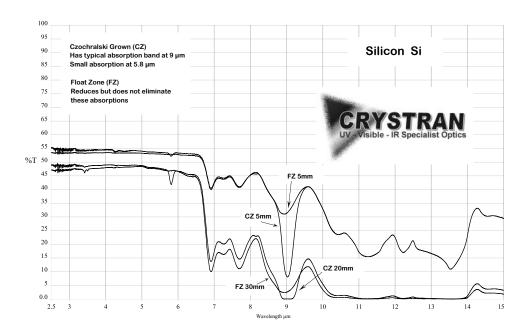
REFERENCES:

(1) Handbook Optical Constants, ed Palik, V1, ISBN 0-12-544420-6

- (2) Li, Refractive Index of Germanium etc, J.Phys Chem, V9, p561, 1980
- (3) Icenogle et al, Appl. Opt. V15, 2348 (1976)
- (4) Wortman & Evans, V36, (1), P153 (1965)

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μm	No	μm	No	μm	No
1.357	3.4975	1.367	3.4962	1.395	3.4929
1.5295	3.4795	1.660	3.4696	1.709	3.4664
1.813	3.4608	1.970	3.4537	2.153	3.4476
2.325	3.4430	2.714	3.4358	3.000	3.4320
3.303	3.430	3.500	3.4284	4.000	3.4257
4.258	3.4245	4.500	3.4236	5.000	3.4223
5.500	3.4213	6.000	3.4202	6.500	3.4195
7.000	3.4189	7.500	3.4186	8.000	3.4184
8.500	3.4182	10.00	3.4179	10.50	3.4178
11.04	3.4176				



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