Silicon (Si)

Specialist Data Sheet

Product Name	Silicon (Si)
Transmission Range	1.2 ~ 15 µm
Refractive Index	3.4223 @ 5 µm
Reflection Loss	46.2% @ 5 µm (2 surfaces)
Absorption Coefficient	0.01 @ 3 µm
Reststrahlen Peak	n/a
dN/dT	160 x 10^{-6} /℃
dN/du	10.4 µm
Density	2.33 g/cc
Melting Point	1420 ℃ (softening)
Thermal Conductivity	163.3 W m^{-1} K^{-1} @ 273K
Thermal Expansion	4.15 x 10^{-6} /℃
Hardness	Knoop 1150
Specific Heat Capacity	703 J Kg^{-1} K^{-1}
Dialectric Constant	13 @ 10 GHz
Youngs Modulus (E)	131 GPa
Shear Modulus (G)	79.9 GPa
Bulk Modulus (K)	102 GPa
Elastic Coefficients	C11=167; C12=65; C44=80
Apparent Elastic Limit	124.1 Mpa (18000 psi)
Poisson Ratio	0.266
Solubility	Insoluble in Water
Molecular Weight	28.09
Class/Structure	Cubic diamond, Fd3m

Notes:

Silicon is grown by Czochralski pulling techniques (CZ) and contains some oxygen which causes an absorption band at 9 microns. To avoid this, material 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 microns. Silicon has a further pass band 30 to 100 microns which is effective only in very high resistivity uncompensated material. Doping is usually boron (p-type) and phosphorus (n-type).

Application:

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 with polished faces are also employed as targets in neutron physics experiments

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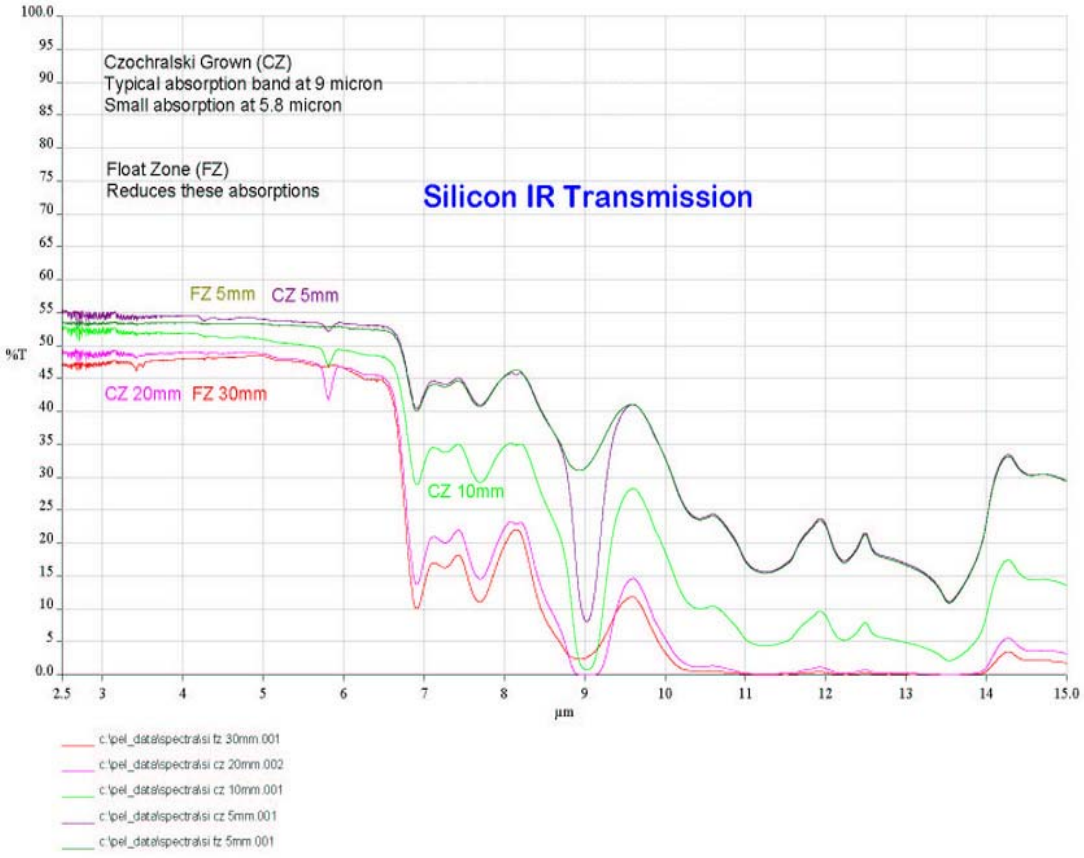
µm	No	µm	No	µm	No	µm	No
1.357	3.4975	1.970	3.4537	4.000	3.4257	7.000	3.4189
1.367	3.4962	2.153	3.4476	4.258	3.4245	7.500	3.4186
1.395	3.4929	2.325	3.4430	4.500	3.4236	8.000	3.4184
1.5295	3.4795	2.714	3.4358	5.000	3.4223	8.500	3.4182
1.660	3.4696	3.000	3.4320	5.500	3.4213	10.00	3.4179
1.709	3.4664	3.303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

Transmission Range Graph:



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