Properties of Silicon - Optical

Unless otherwise specified, all information is for 25°C.

Physical Properties

Symbol _____ Si
Atomic Number _____ 14
Atomic Weight _____ 28.086
Crystal Structure _____ diamond cubic
Density, g/cm^3 _____ 2.329
Atomic density, atoms/ cm^3 ___ 5.00 x 10^{22}
(at 20°C)
Lattice Constant, nm _____ 0.543089
(at 23°C)
Surface Tension, mN/m (=dyne/cm) __ 736
(liquid at melting point)
Modulus of Rupture
MPa _____ 125
PSI _____ 1.8 x 10^4
Mohs Hardness _____ 7
Poisson's Ratio, 125-375K _____ 0.279
Elastic Constants, cm^2/dyne
S_{11} = 7.68 x 10^{-13}
S_{12} = -2.14 x 10^{-13}
S_{44} = 12.56 x 10^{-13}
Elastic Coefficients, dynes/cm^2
C_{11} = 16.57 x 10^{11}
C_{12} = 6.39 x 10^{11}
C_{44} = 7.96 x 10^{11}

Thermal Properties

Melting Point, °C _____ 1412
Boiling Point, °C _____ 2878
Heat Capacity, cal/(mole K)
Solid _____ 4.78
Liquid at melting point _____ 6.755
Heat of fusion, cal/g _____ 264
Coefficient of Linear Expansion, 10^{-6}/K
See graph on electrical properties page
Thermal Conductivity, W/(m K)
See graph on electrical properties page

Optical Properties

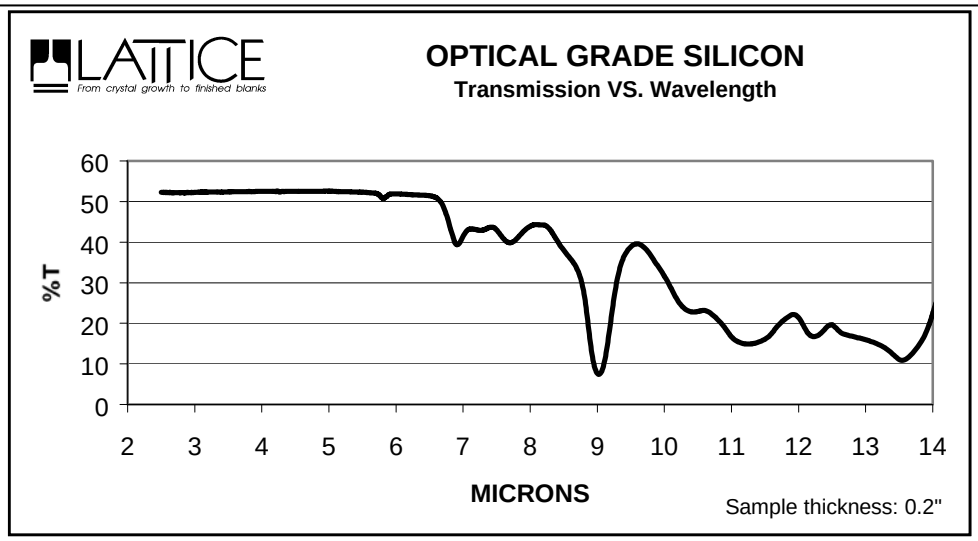
Index of Refraction, @ 25°C
@ 2 microns, n = _____ 3.456
@ 4 microns, n = _____ 3.429
@ 6 microns, n = _____ 3.424
Absorption Coefficient @ 25°C, cm^{-1}
(standard optical grade silicon, varies with resistivity)
@ 2 microns, a = _____ .027
@ 4 microns, a = _____ .038
@ 6 microns, a = _____ .040

Transmission % _____ see graph below

Energy Distribution Calculations:

$T = [(1-r)^2e^{-at}]/[1-r^2e^{-2at}]$
$R = r + [(1-r)^2e^{-2at}]/[1-r^2e^{-2at}]$
$A = (1-r)[1-e^{-at}]/[1-re^{-at}]$

T = fraction of energy transmitted
R = fraction of energy reflected
A = fraction of energy absorbed
r = relfectivity = $[(n-1)/(n+1)]^2$
a = absorption coefficient, cm^{-1}
t = thickness, cm



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