Properties of Germanium - Optical

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

Physical Properties

Symbol ____ Ge
Atomic Number ____ 32
Atomic Weight ____ 72.59
Crystal Structure ____ diamond cubic
Density, g/cm^3 ____ 5.323
Atomic density, atoms/ cm^3 ____ 4.416 x 10^{22}
(at 20°C)
Lattice Constant, nm ____ 0.565754
(at 23°C)
Surface Tension, mN/m (=dyne/cm) ____ 650
(liquid at melting point)
Modulus of Rupture
MPa ____ 72.4
PSI ____ 1.05 x 10^4
Mohs Hardness ____ 6.3
Poisson's Ratio, 125-375K ____ 0.278

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}
Young's Moduli, dynes/cm^2
Y_{100} = 10.33 x 10^{11}
T_{110} = 13.80 x 10^{11}
Y_{111} = 15.55 x 10^{11}

Shear Moduli, dynes/cm^2
M_{100} = 6.69 x 10^{11}
M_{110} = 4.1 x 10^{11}
M_{111} = 4.9 x 10^{11}

Thermal Properties

Melting Point, °C ____ 937.4
Boiling Point, °C ____ 2830
Heat Capacity, J/(kg K) ____ 322
Latent Heat of fusion, J/g ____ 466.5
Coefficient of Linear Expansion, 10^{-6}/K
100 K ____ 2.3
200 K ____ 5.0
300 K ____ 6.0
Thermal Conductivity, W/(m K)
100 K ____ 232
200 K ____ 96.8
300 K ____ 59.9
400 K ____ 43.2

Optical Properties

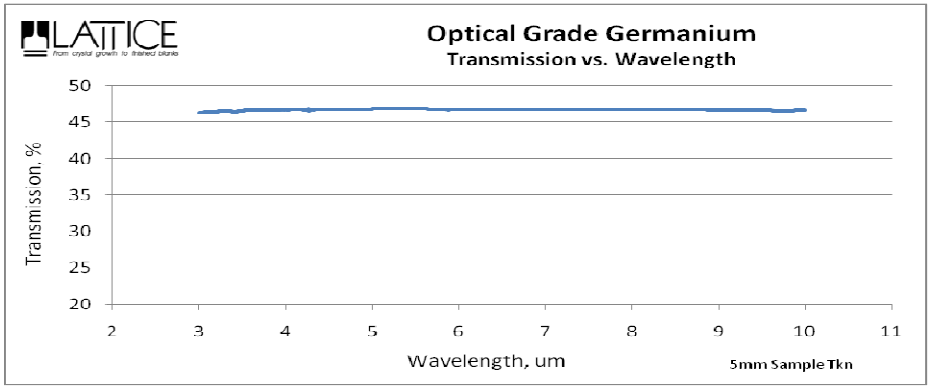
Index of Refraction, @ 25°C
@ 3 microns, n = ____ 4.045
@ 7 microns, n = ____ 4.009
@ 11 microns, n = ____ 4.004
Absorption Coefficient @ 25°C, cm^{-1}
@ 3 microns, a = ____ .0047
@ 7 microns, a = ____ .0107
@ 11 microns, a = ____ .0295

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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