

Germanium is most widely used for lenses and windows in IR systems operating in the 2 μm - 12 μm range. Its transmission is very temperature sensitive, becoming opaque near 100°C. Environment does not cause problems because Germanium is inert, mechanically rugged, and fairly hard.

Germanium is a high index material that is used to manufacture Attenuated Total reflection (ATR) prisms for spectroscopy. Its refractive index is such that germanium makes an effective natural 50% beamsplitter without the need for coatings. It is also used extensively as a substrate for production of optical filters. Germanium covers the whole of the 8-14 micron thermal band and is used in lens systems for thermal imaging. It can be AR coated with diamond producing an extremely tough front optic.

Application as window, lens, beamsplitter, ATR prism or filter in spectrometers and in thermal imaging.

Main Properties

Crystal properties			
Crystal Growth Method		Czochralski pulling techniques	
Maximum Size		< 椀 250mm	
Optical properties			
Transmission Range		2.0~17 μm	
Reflection Loss, for two surfaces at 11 μm		53%	
Refractive Index		See below	
Wavelength (μm)	Refractive Index (n)	Wavelength (μm)	Refractive Index (n)
2.0	4.1079	9.0	4.0047
3.0	4.0446	10.0	4.0040
4.0	4.0242	11.0	4.0031
5.0	4.0153	12.0	4.0029
6.0	4.0106	12.5	4.0024
7.0	4.0076	13.02	4.0021
8.0	4.0053	15.0	4.0017
Transmission Curve See below			



Crystallographic properties	
Syngony	Cubic
Crystal Form	Poly or Single Crystal
Lattice Constant	5.66
Cleavability	<111>, non-perfect
Molecular Weight	72.60
Physical properties	
Density, at 20 掬 C	5.33
Hardness, Mohs	6.3
Dielectric Constant for 9.37 腦 109 Hz at 300 K	16.6
Melting	937
Thermal Conductivity, W/m 路 K at at 293 K	59
Thermal Expansion, 1/K at 298 K	6.1 腦 10-6
Specific Heat Capacity, J/(kgK) at 273-373 K	0.074
Bandgap, eV	0.67
Knoop Hardness, kg/mm2	800
Young's Modulus, Gpa	102.66
Shear Modulus, GPa	67.04
Bulk Modulus, GPa	77.86
Debye Temperature, K	370
Poisson's Ratio	0.278
Elastic Coefficient	C11=129, C12=48.3, C44=67.1
Apparent Elastic Limit	89.6 MPa (13000psi)

Chemical properties	
Solubility in water	None
Solubility in acids	Soluble
Molecular Weight	72.59