OPTICAL MATERIALS : INFRA-RED

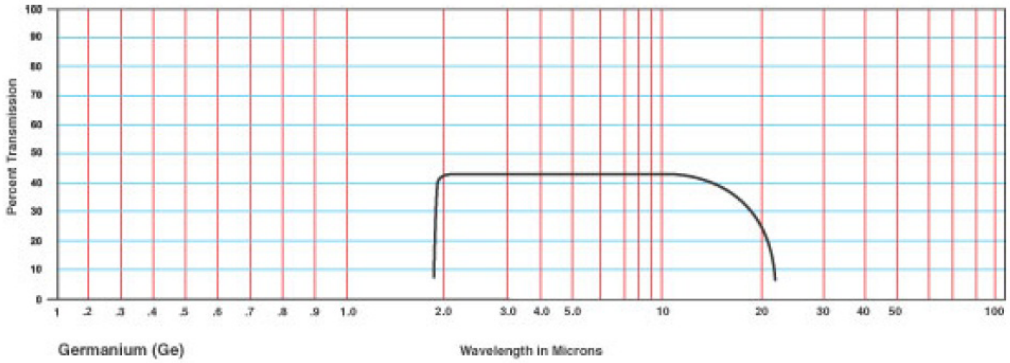
Title: Optical material/ crystals (Infrared)

Material/Specification: Germanium for 1.8µm to 23µm transmission

Range/Description: OPMI-GERMANIUM

Germanium is a hard, grayish-white element that has a metallic luster and the same crystal structure as diamond. Germanium is a highly important infrared optical material and can be readily cut and polished into lenses and windows. It is used particularly as the front optic in thermal imaging cameras working in the 8 to 14 micron wavelength range for passive thermal imaging and for hot-spot detection in military and fire fighting applications.

Internal Transmittance



Internal Transmittance $\tau_i(\lambda)$ vs. wavelength λ											
λ,MKM	3	5	6	7	8	9	10	12	15	20	—-
$\tau_i(\lambda)$	0.97	0.97	0.97	0.97	0.97	0.97	0.96	0.70	0.56	0.05	—-

Refractive Index n vs. Wavelength λ															
λ, MKM	—-	—-	—-	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	11	12	12.5	15
n(l)	—-	—-	—-	4.10	4.04	4.02	4.01	4.01	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Optical Properties	
Transmission Range	1.8 to 23 micron
Refractive Index	4.0026 at 11 micron
Refractive Loss	53% at 11 micron
Crystal/Class Structure	Cubic Diamond, Fd3m
Cleavage Plane	(111), non-perfect

Thermal Properties	
Thermal Expansion	6.1 x 10^{-6}/°C at 298K
Thermal Conductivity	58.61 W m^{-1} K^{-1} at 293K
Melting Point	936 °C
Specific Heat Capacity	310 J Kg^{-1} K^{-1}

Mechanical Properties	
Density	5.33 g/cc
Hardness (Knoop)	Knoop 780
Youngs Modulus	102.7 GPa
Shear Modulus	67 GPa
Bulk Modulus	77.2 GPa
Poisson Ratio	0.28
Elastic Limit	89.6 MPa (13000 psi)
Molecular Weight	72.59

Chemical Properties	
Solubility	Insoluble in water.

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