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[Germanium\(Ge\) Windows for Thermal Imaging](#)

Germanium windows are ideal for IR applications with its broad transmission range and opacity in the visible portion of the spectrum. Germanium has a high index of refraction, making it a perfect choice for applications that require low dispersion. Germanium is commonly used in IR imaging systems typically operating in the 2 μm to 12 μm spectral range, covers the LWIR (8-12 μm) and MWIR (3-5 μm) thermal imaging wavelength range. Germanium can be AR coated with Diamond producing an extremely tough front optic. Germanium is more rugged than other IR materials, but caution should be taken for high temperature applications where the material will become opaque in the IR realm as the temperature rises.



Features and Abilities:

- ◆ Diameter range: $\sim 300\text{mm}$;
- ◆ Various types of coating:
 - AR/AR@7-14 μm ;
 - DLC (diamond or hard carbon coating)/AR@7-14 μm ; BBAR/BBAR@3-12 μm ;
 - Customized coating;

Modules or Types:

Germanium(Ge) Windows Stocks:

No.	Diameter	Thickness	Surface Quality	Coating
320-001	10.0(+0/-0.1)mm	2.0(+/-0.05)mm	60/40 S/D	AR/AR
320-002	12.0(+0/-0.1)mm	1.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-003	12.0(+0/-0.1)mm	1.0(+/-0.05)mm	60/40 S/D	AR/AR
320-005	18.0(+0/-0.1)mm	1.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-006	20.0(+0/-0.1)mm	1.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-007	25.4(+0/-0.1)mm	1.0(+/-0.05)mm	60/40 S/D	Uncoated
320-008	25.4(+0/-0.1)mm	1.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-009	29(+0/-0.1)mm	2.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-010	33.0(+0/-0.1)mm	1.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-011	50.8(+0/-0.1)mm	3.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-012	52.0(+0/-0.1)mm	3.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-013	60.0(+0/-0.1)mm	2.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-014	60.0(+0/-0.1)mm	3.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-015	65.0(+0/-0.1)mm	3.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-016	70.0(+0/-0.1)mm	3.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-017	76.0(+0/-0.1)mm	3.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-018	80.0(+0/-0.1)mm	3.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-019	85.0(+0/-0.1)mm	3.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-020	91.8(+0/-0.1)mm	3.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-021	100.0(+0/-0.1)mm	4.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-022	101.6(+0/-0.1)mm	1.0(+/-0.05)mm	60/40 S/D	DLC/AR
320-023	101.6(+0/-0.1)mm	4.0(+/-0.05)mm	60/40 S/D	DLC/AR

Specifications:

Specifications	
Materials	Optical grade germanium single crystals
Aperture	>90%
Dimension Tolerance	+0.0/-0.2mm
Thickness Tolerance	+/-0.2mm
Surface Quality	80/50 S/D
Parallelism	1 arc minute
Chamfer	0.3-0.5mm x 45 degree
Coating	AR/AR@7-14μm DLC/AR@7-14μm BBAR/BBAR@3-12μm See the curves below

Basic Properties:

Physical and Optical Properties	
Transmission Range	1.8 to 23 μm

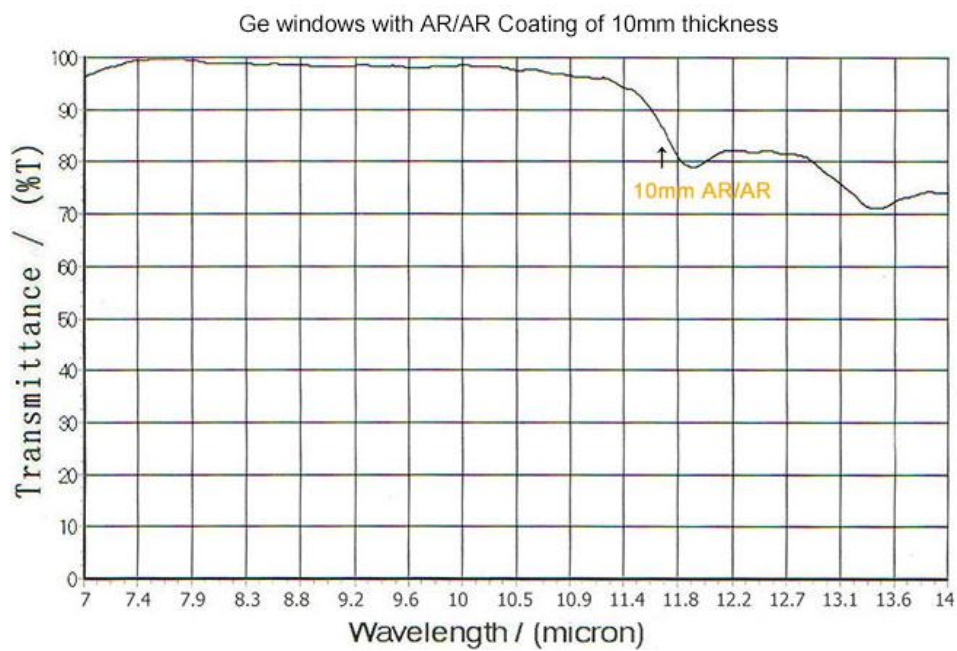
Refractive Index	4.0026 at 11 μm
Reflection Loss	53% at 11 μm (Two surfaces)
Absorption Coefficient	$<0.027 \text{ cm}^{-1}$ @ 10.6 μm
Reststrahlen Peak	n/a
dn/dT	$396 \times 10^{-6} / ^\circ\text{C}$
$dn/d\mu = 0$	Almost constant
Density	5.33 g/cc
Melting Point	936 $^\circ\text{C}$
Thermal Conductivity	58.61 W m ⁻¹ K ⁻¹ @ 293K
Thermal Expansion	$6.1 \times 10^{-6} / ^\circ\text{C}$ @ 298K
Hardness	Knoop 780
Specific Heat Capacity	310 J Kg ⁻¹ K ⁻¹
Dielectric Constant	16.6 at 9.37 GHz @ 300K
Youngs Modulus (E)	102.7 GPa
Shear Modulus (G)	67 GPa
Bulk Modulus (K)	77.2 GPa
Elastic Coefficients	C11=129; C12=48.3; C44=67.1
Apparent Elastic Limit	89.6 MPa (13000 psi)
Poisson Ratio	0.28
Solubility	Insoluble in water
Molecular Weight	72.59
Class/Structure	Cubic Diamond, Fd3m

Transmission Curves

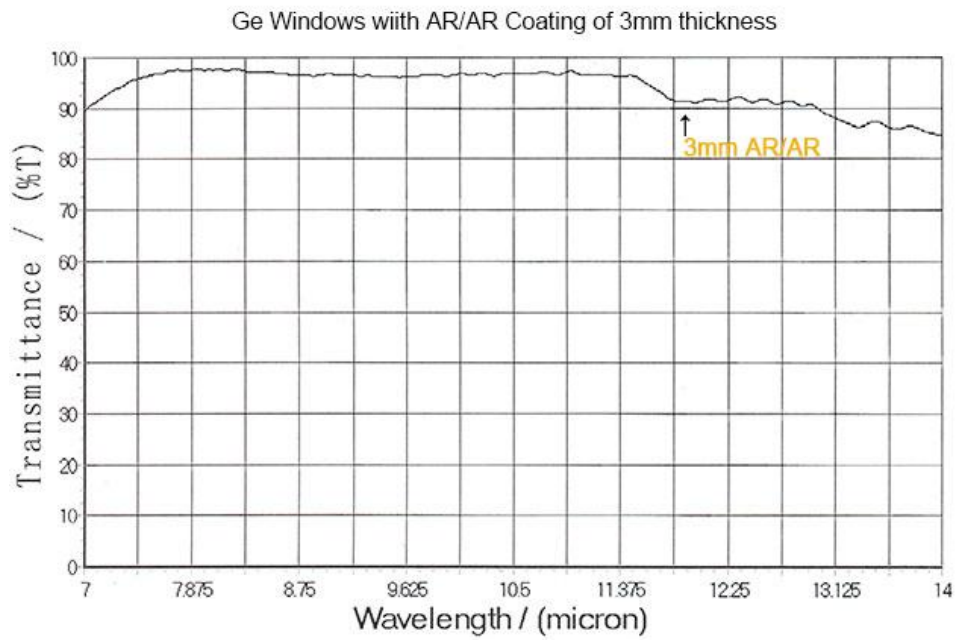
1. Transmission curve 1, transmission of Ge windows with no coating



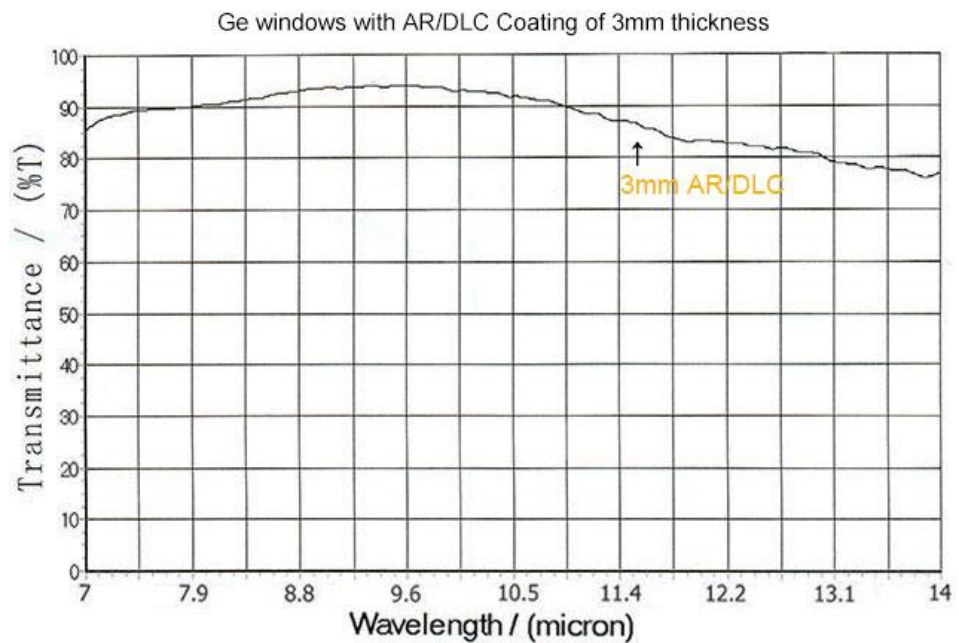
2. Transmission curve for Ge windows with coating AR/AR of 10mm thickness



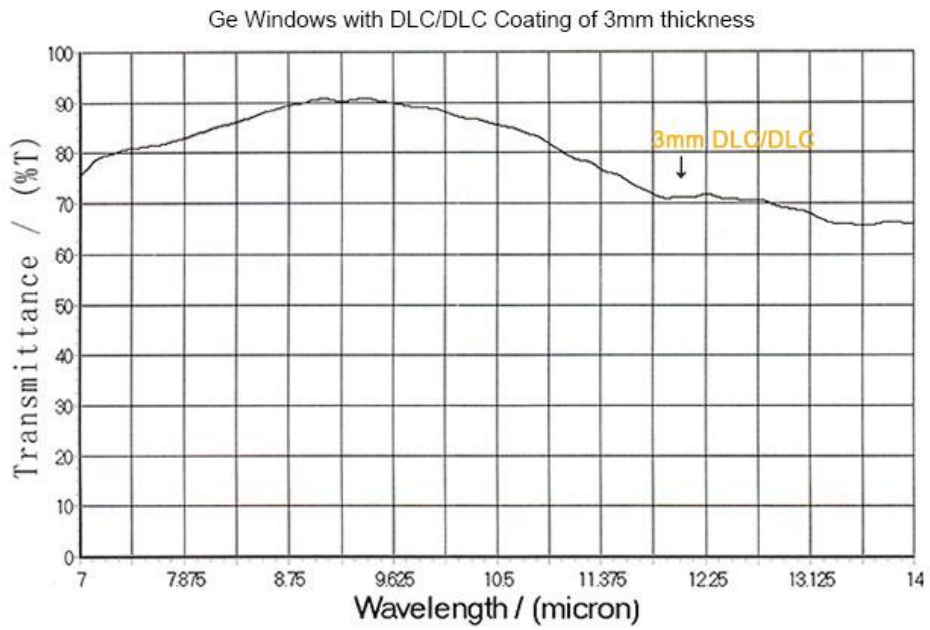
3. Transmission curve for Ge windows with coating AR/AR of 3mm thickness



4. Transmission curve for Ge windows with coating AR/DLC of 3mm thickness



5. Transmission curve for Ge windows with coating DLC/DLC of 3mm thickness



6. Transmission curve for Ge windows with coating AR/AR of 1mm thickness

