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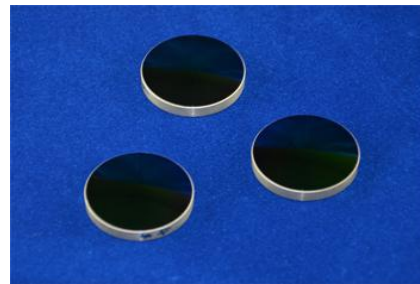
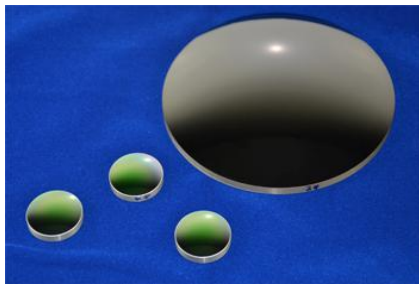
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### [Germanium Lenses](#)

Germanium lenses (Ge lenses) is commonly used in IR imaging systems typically operating in the 2  $\mu\text{m}$  to 16  $\mu\text{m}$  spectral range, covers the LWIR (8-12 $\mu\text{m}$ ) and MWIR (3-5 $\mu\text{m}$ ) thermal imaging applications. Germanium has the highest refractive index of commonly available IR-transmitters and has low optical dispersion. This makes it desirable in aspects of lens design where its refractive index allows otherwise impossible specifications to be built.



#### **Specifications:**

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Materials	Optical grade germanium single crystals
Diameter Range	~300mm
Diameter Tolerance	-0.01/-0.03mm
Thickness Tolerance	+/-0.03mm
Surface Quality	60/40 S/D
Frings (N)	3
Irregularity (delta N)	1
Centration	3'
Chamfer	0.1-0.3mmx45 degree
Coatings	AR/AR@7-14micro DLC/AR@7-14micro BBAR/BBAR@3-12 micro See coating curves below

Note: the domes of other specifications is available upon customer's request

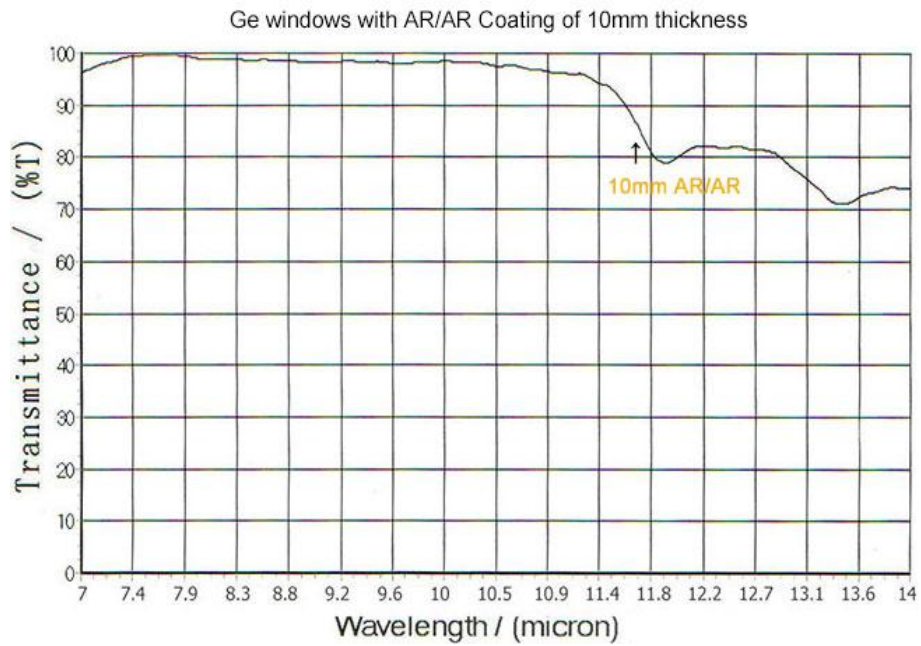
## Basic Properties:

Physical and Optical Properties	
Transmission Range	1.8 to 23 $\mu\text{m}$
Refractive Index	4.0026 at 11 $\mu\text{m}$
Reflection Loss	53% at 11 $\mu\text{m}$ (Two surfaces)
Absorption Coefficient	$<0.027 \text{ cm}^{-1}$ @ 10.6 $\mu\text{m}$
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 <sup>-1</sup> K <sup>-1</sup> @293K
Thermal Expansion	$6.1 \times 10^{-6} / ^\circ\text{C}$ @ 298K
Hardness	Knoop 780
Specific Heat Capacity	310 J Kg <sup>-1</sup> K <sup>-1</sup>
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
Poisson Ratio	0.28
Solubility	Insoluble in water
Molecular Weight	72.59
Class/Structure	Cubic Diamond, Fd3m

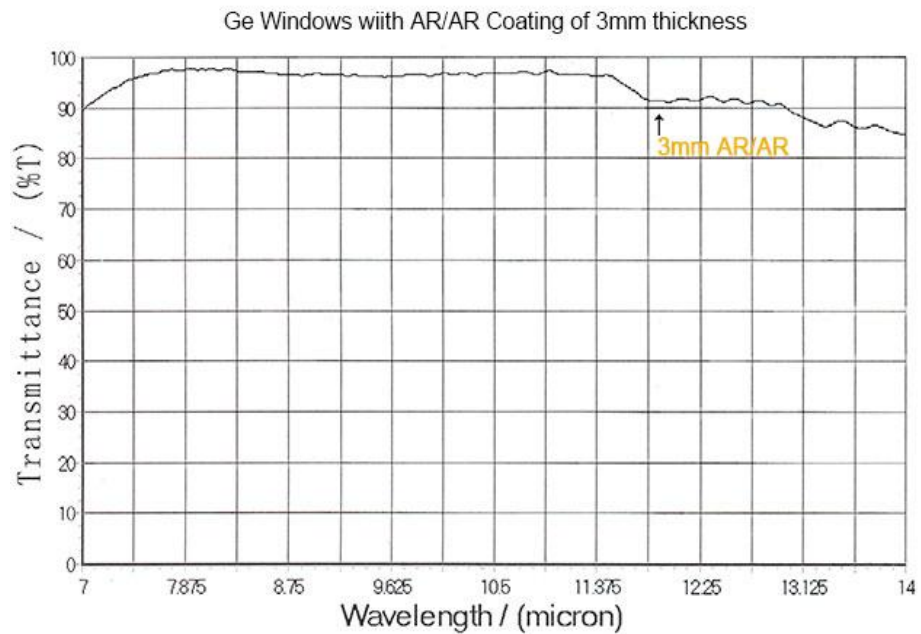
### 1. Transmission curve 1, Transmission of Ge windows with no Coating



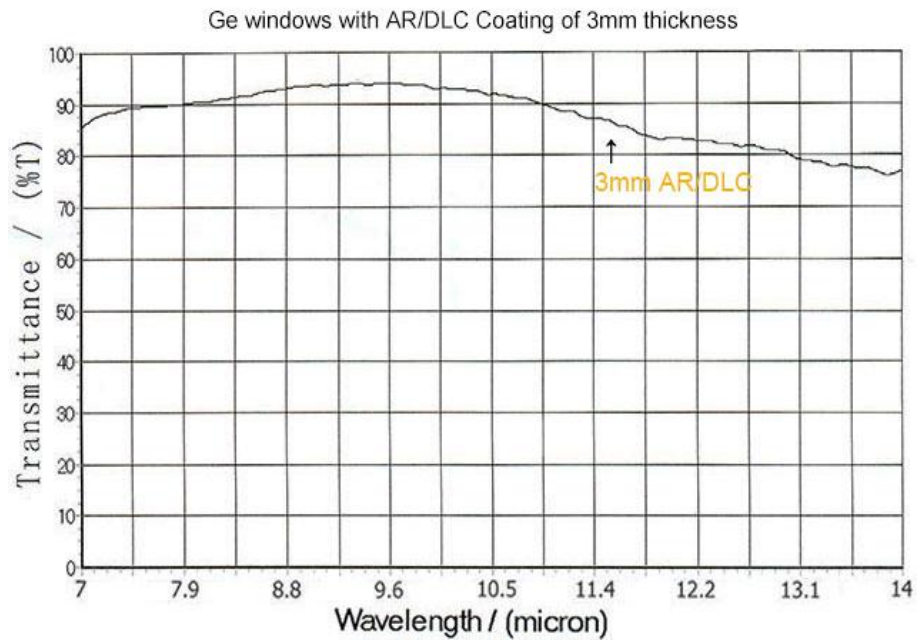
**2. Transmission curve for Ge windows with coating AR/AR of 10mm thickness**



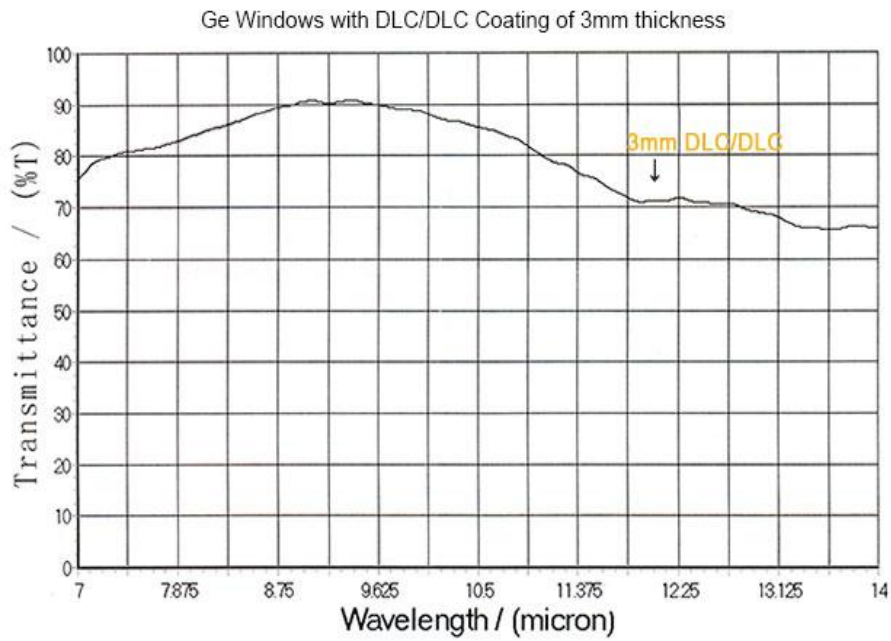
**3. Transmission curve for Ge windows with coating AR/AR of 3mm thickness**



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

