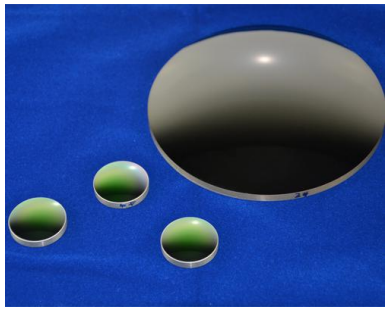
Germanium Lenses



Features:

- Maximum diameter: 300mm
- Long wave length range from 2 to 16 micro
- Fit for both MWIR (3-5 micro) and LWIR (8-12 micro) thermal imaging applications
- Various types of coating available

Descriptions:

Germanium lenses (Ge lenses) is commonly used in IR imaging systems typically operating in the 2 µm to 16 µm spectral range, covers the LWIR (8-12µm) and MWIR (3-5µm) 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. Germanium can be Diamond or DLC coated which produce an extremely tough front optic, and it is often used as the front optics in lens group. 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. Beside the general spherical surface lenses, Hangzhou Shalom EO also provide the aspherical surface lenses made by SPDT (Single Point Diamond Turning) technique.

Hangzhou Shalom EO suppliers a variety types of lenses: plano-convex, plano-concave, double convex, double concave and meniscus With spherical and aspherical lens surface.

And Various types of coating are available:

- AR/AR@7-14um;
- DLC (diamond or hard carbon coating)/AR@7-14um;
- BBAR/BBAR@3-12um;
- Customized coating;

Specifications:

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'

Addr. Room A635, Boke Mansion, No.9 Xiyuan Road, Xihu District, Hangzhou 310030, China.
Tel:+86-571-87920630 Fax:+86-571-87603342 E-mail:sales@shalomeo.com Home:www.shalomeo.com

Chamfer	0.1-0.3mmx45 degree	Coatings	AR/AR@7-14micro DLC/AR@7-14micro BBAR/BBAR@3-12 micro See coating curves below

Physical and Optical Properties:

Transmission Range	1.8 to 23 μm (1)	Refractive Index	4.0026 at 11 μm (1)(2)
Reflection Loss	53% at 11 μm (2 surfaces)	Absorption Coefficient	<0.027 cm^{-1} @ 10.6 μm
Reststrahlen Peak	n/a	dn/dT	396 x 10^{-6} /°C (2)(6)
dn/dμ = 0	Almost constant	Density	5.33 g/cc
Melting Point	936 °C (3)	Thermal Conductivity	58.61 W m-1 K-1 at 293K (6)
Thermal Expansion	6.1 x 10^{-6}/°C at 298K (3)(4)(6)	Hardness	Knoop 780
Specific Heat Capacity	310 J Kg-1 K-1 (3)	Dielectric Constant	16.6 at 9.37 GHz at 300K
Youngs Modulus (E)	102.7 GPa (4) (5)	Shear Modulus (G)	67 GPa (4) (5)
Bulk Modulus (K)	77.2 GPa (4)	Elastic Coefficients	C11=129; C12=48.3; C44=67.1 (5)
Apparent Elastic Limit	89.6 MPa (13000 psi)	Poisson Ratio	0.28 (4) (5)
Solubility	Insoluble in water	Molecular Weight	72.59
Class/Structure	Cubic Diamond, Fd3m		

Resources:

Application Notes:

Germanium (Ge) is a relatively hard, high-density, IR transmitting material that blocks UV and VIS wavelengths but allows IR from 2μm. 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. AR coating is recommended.

Germanium transmits over 45% between 2-14μm up to 45°C but transmission degrades slowly at 100°C then more rapidly above 200°C. Exposure to higher temperatures can lead to catastrophic failure in the material so Germanium is unsuitable for use in these conditions. Additionally, its relatively high density should be considered where weight is an issue. Germanium has a hardness of HK780, slightly higher than GaAs with which it shares similar mechanical properties.

Typical applications for Germanium include thermal imaging where the material can be

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used as a front optic while its index of refraction makes Germanium useful for wide-angle lenses and microscopes. Additionally, Germanium components can be used for FLIR (Forward Looking Infrared) and FTIR (Fourier Transformed Infrared) spectroscopy systems, alongside other analytical instruments.

In order to lower the cost and improve the imaging quality of les assemblies used in thermal imaging cameras, the aspherical surfaces is used in the design of lens group. Hangzhou shalom EO provide the spherical surface lenses made by SPDT (Single Point Diamond Turning) technique, we'll manufacturing the lens optics according to your request.

Technical images:

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

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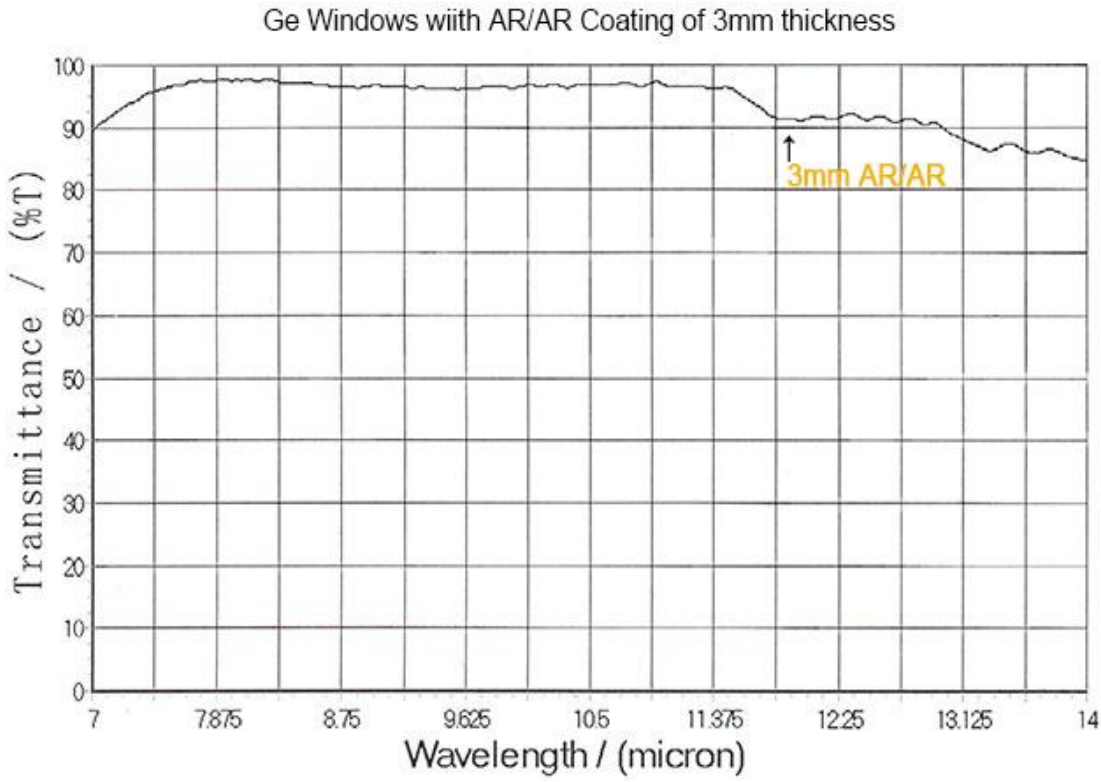
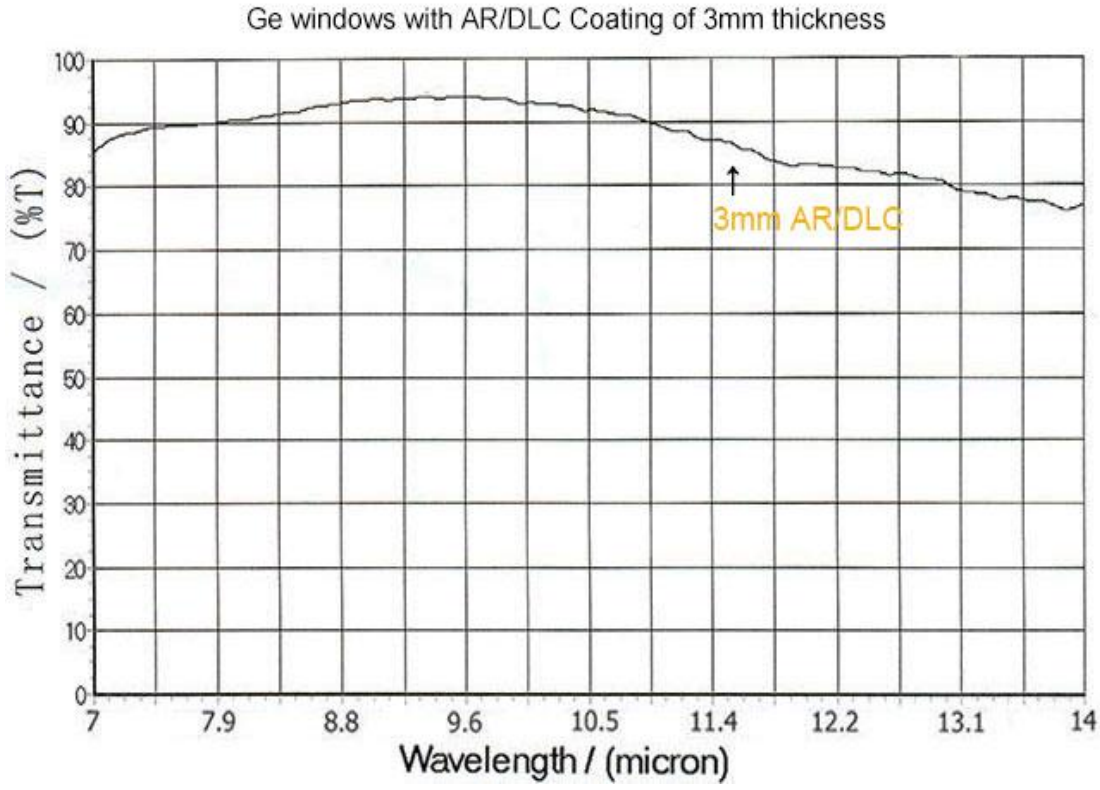
2. Transmission curve for Ge windows with coating AR/AR of 3mm thickness



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



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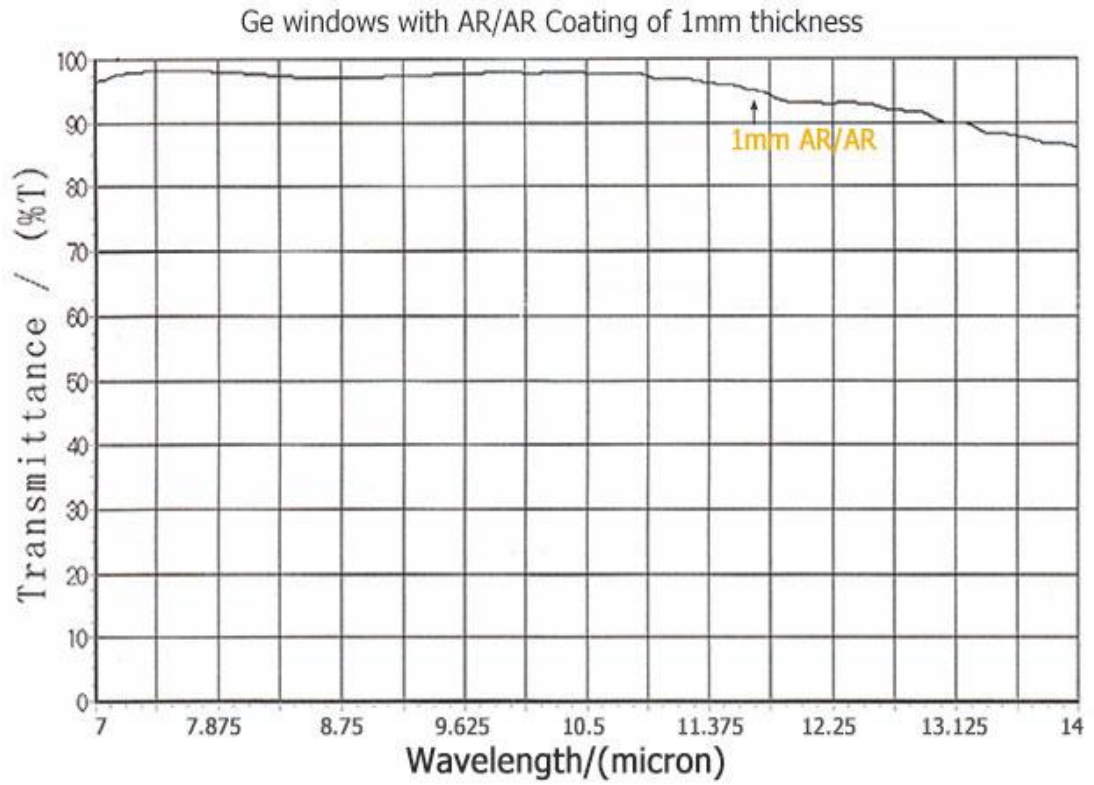
4. Transmission curve for Ge windows with coating AR/AR of 1mm thickness



Related products:

1) Infrared lenses -> ZnSe lenses
2) Infrared lenses -> Chalcogenide lenses and balls
3) Infrared windows -> Ge windows

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