

Introduction

WTS Photonics Co., Ltd

WTS Photonics Co., Ltd provide our customers with the superior quality optics products and precision Laser Optics products ,serves a global markets including Laser, Electronics, Telecommunication,Thermal Imaging, Infrared Sensor for Industrial, Medical and Scientific Research applications. We are headquartered in Fuzhou, China.



WTS Photonics key products include Optical Lenses, Windows, Mirrors, Filters,precision Prisms, Customer Optics and Sapphire, Quartz, MgF2, CaF2, Ge, Silicon etc..Our many experienced engineers can design customer optical assemblies and specialty coatings to meet your specific requirements.Our professional,skillful and experienced technicians take pride in consistently fabricating high quality products.Our specialist team have ever worked on the photonics industry for more than eleven years.



WTS Photonics owns strong production capability in our modern workshops, At present, we employ 150 staff, among whom one third are professionals taking the responsibility of R&D and directing the production practice. equipment includes a Zygo GPI-XP interferometer, Spectrophotometers, Perkin-Elmer Lambda 900,a radius tester, a focus tester. Our large quality department tightly controls manufacturing processes and quality procedures and keeps inspection records to comply with the strict ISO 9001 standards. And of course, test reports are provided with our optics upon request.



WTS Photonics can meet your requirements perfectly.



“High Quality

Quick Response

Timely Delivery”



Contents

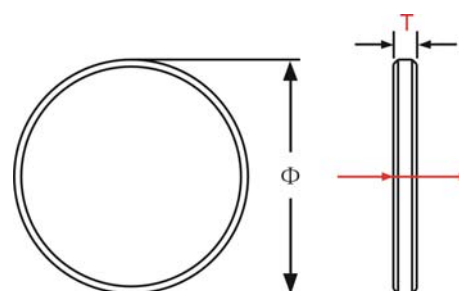
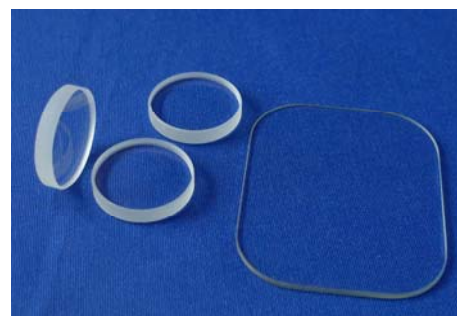
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Optical Windows

● Windows

Windows are applied to isolate different physical environments while allowing light to pass. When selecting windows, it's important to consider materials, transmission, scattering, wavefront distortion, parallelism and resistance to certain environment. WTS offers all kinds of windows, which are made from different materials. Windows of special sizes and materials are available upon requirement.

Single layer or multiplayer anti-reflecting or high-reflecting coating on optical windows are available upon customer's requirement.



Windows Materials Properties

Material	Properties	Application
N-BK7	Transmission range:330-2100nm Refractive index:1.5168@588nm	Good performance over visible and near IR spectrum for most application.
Fused Silica	Transmission range:185-2500nm Refractive index: 1.45847@589.3nm Low thermal expansion coefficient	Better performance from UV to IR spectrum.Also,it's the best choice for resistance thermal application.
Sapphire	Transmission range:180-4500nm Refractive index: 1.755@1000nm Strong hardness	Suit for scratch resistance application with better transmission.
CaF2	Transmission range:170-7800nm Refractive index: 1.399@5000nm Little hygroscopic susceptibility High thermal expansion coefficient	It is applicable for wide rang spectrumand it's particularly useful for IR laser application.
MgF2	Transmission range:120-7000nm Refractive index: 1.376@700nm	It is applicable for wide range spectrum, and it is particularly useful for Excimer laser application.
Silicon	Transmission range: 1.2-100um Refractive index: 3.422@5um	It is widely used in IR sensors, thermal image, medical, and optical measurement systems.
Germanium	Transmission range: 1.9-17um Refractive index: 4.004@10um	Mainly are used in semiconductor etc IR optics.

Note: Other window materials: Pyrex, Float glass, B270, Borofloat, ZnSe ,etc.

Optical Windows

● All Surfaces Polished Glass Cube

Our company offers the glass cube with all the surfaces polished by advanced polishing technic. The high surface quality as 20-10 (scratch –dig), flatness as better than $\lambda/10$ are achievable.



Single Plate Window

Specifications	Standard	High precision
Material	BK7, B270, Float Glass , CaF2, Ge, Si, Sapphire, Fused Silica, etc.	
Dimension Tolerance	+0.0, -0.15mm	+0.0, -0.05mm
Thickness Tolerance	±0.2mm	±0.05mm
Surface Quality	60-40 (scratch –dig)	20-10 (scratch –dig)
Flatness	$\lambda/2$ per 25mm @ 632.8nm	$\lambda/10$ per 25mm @ 632.8nm
Parallelism	<1 arc mins	<10 arc secs
Clear Aperture	>85%	>90%
Bevel	<0.25mmx45deg.	
Coating	Upon requirement	

All Surfaces Polished Glass Cube

Specifications	Standard	High precision
Material	BK7, Fused Silica ,Sapphire, etc.	
Dimension Tolerance	+0.0, -0.10mm	+0.0, -0.02mm
Surface Quality	60-40 (scratch –dig)	20-10 (scratch –dig)
Flatness	$\lambda/2$ per 25mm @ 632.8nm	$\lambda/10$ per 25mm @ 632.8nm
Parallelism	<1 arc mins	<10 arc secs
Clear Aperture	>90%	>95%
Beve	<0.25mmx45deg.	No Bevel
Chip	<0.2mm	<0.05mm
Coating	Upon requirement	

Optical Lenses

● Lenses

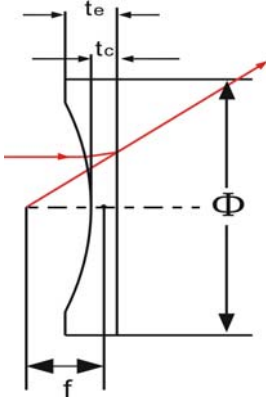
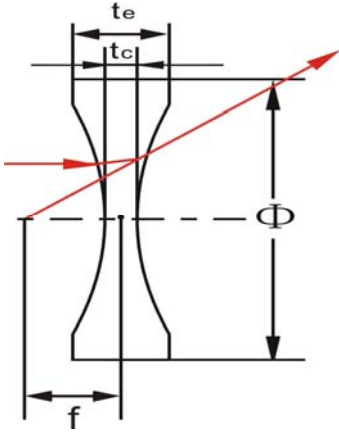
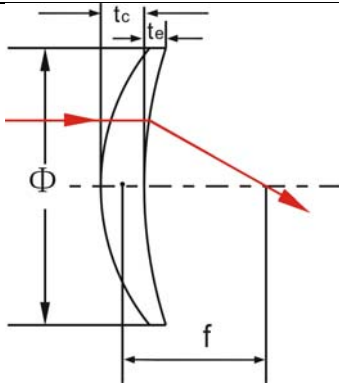
Lenses have many applications ranging from the simple collection of a laser beam to precise imaging and image transfer. Lenses are classified as single lenses, cylindrical lenses and achromatic lenses. These lenses are made of BK7, Fused Silica CaF₂ and other optical material. Special focusing systems can be designed by our engineers upon request.



Lenses	Illustration	Properties and Applications
<p>Plano-convex</p>		<p>They are used to collimate diverging light or to focus collimated light. We use them as secondary focusing lenses to refocus the collimated light sources. Plano-convex lenses have low spherical aberration. Use them with the plano side facing the point source or the focus and the curve side towards the collimated beam.</p>
<p>Bi-Convex</p>		<p>It is most suitable where the object and image are on opposite sides of the lens and the ratio of the image and object distances is between 0.2 to 5.</p>

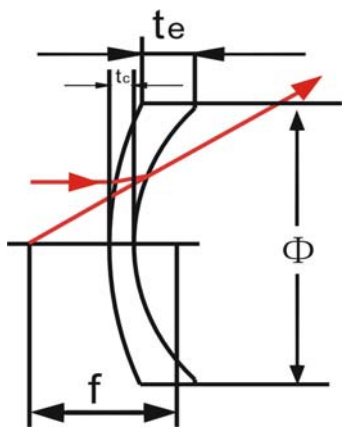
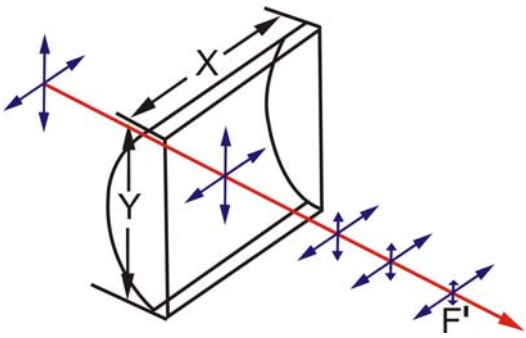
Optical Lenses

● Lenses

Lenses	Illustration	Properties and Applications
<p>Plano-Concave</p>		<p>Has a negative focal length,diverges collimated incident light, and forms only virtual images which are seen through the lens. It is often used to expand light beams or increase focal lengths in existing systems.</p>
<p>Bi-Concave</p>		<p>It is like the Plano-Concave lens in that it is used to produce divergent light. The Double-Concave lens is best used when the input beam is converging.</p>
<p>Positive Meniscus</p>		<p>Positive meniscus lens is a convex-concave lens thicker at the center than at the edges. It is used to minimize spherical aberration. When used in combination with another lens, it's will shorten the focal length, and increase the NA of system.</p>

Optical Lenses

● Lenses

Lenses	Illustration	Properties and Applications
<p>Negative Meniscus</p>		<p>Negative meniscus lens is a convex-concave lens thinner at the center than edges. It increases the divergence of the beam without introducing any significant spherical aberration. When used in combination with another lens, it will increase the focal length, and decrease the NA of the system.</p>
<p>Cylindrical</p>		<p>Cylindrical lens have at least one surface that is formed like a portion of a cylinder. Cylindrical lenses are used to correct astigmatism in the eye, and, in rangefinders, to produce astigmatism, stretching a point of light into a line. Some styles of cylindrical lenses have antireflective coatings to increase the transmission of light through the lens.</p>

Optical Lenses

● Lenses

Lenses	Illustration	Properties and Applications
<p>Achromatic</p>		<p>Achromatic lens a positive low-index Crown Glass lens element cemented to a negative high-index Flint Glass lens element. The elements are chosen so as to cancel chromatic aberration at two well-separated wavelengths, usually in the blue and red region of the spectrum. Focal length is constant at those two wavelengths and focal length shifts are virtually eliminated across the visible wavelengths. One frequent use is to achieve diffraction limited focusing of a laser beam. Negative Achromats are typically used when there is a need to eliminate chromatic aberration. In addition to reducing chromatic aberration at the design wavelengths, spherical aberration and coma are greatly reduced.</p>

Specifications	Standard	High precision
Material	grade A optical glass, Fused Silica ,Sapphire,Si ,Ge, etc.	
Diameter Tolerance	+0.0, -0.10mm	+0.0, -0.05mm
Thickness Tolerance	±0.1mm	±0.05mm
Surface Quality	60-40 (scratch –dig)	20-10 (scratch –dig)
Surface Figure	lambda/2 @632.8nm	lambda /4 @ 632.8nm
Centration	±3 arc minutes	±1 arc minutes
Clear Aperture	>85%	>90%
Beve	<0.25mmx45deg.	<0.25mmx45deg.
Coating	Upon requirement	

Optical Lenses

● IR Lenses

IR lens is widely used in image sensor, medical and army applications. Silicon, CaF₂ and Germanium are our favor in this production line. WTS also can provide AR coating on this IR application. WTS's engineers can design special focusing systems upon your requirement.



Specifications	Standard	High precision
Material	Silicon, CaF ₂ , Germanium, ZnS, etc	
Diameter Tolerance	+0.0, -0.10mm	+0.0, -0.05mm
Thickness Tolerance	±0.1mm	±0.05mm
Surface Quality	60-40 (scratch –dig)	40-20 (scratch –dig)
Surface Figure	λ/2 @ 632.8nm	λ/4 @ 632.8nm
Centration:	±3 arc minutes	±1 arc minutes
Clear Aperture	>85%	>90%
Beve	<0.25mmx45deg.	<0.25mmx45deg.
Coating	Upon requirement	

Note: We will also production Ball Lenses, Rod Lenses, Micro Components- Cone Lenses.

Optical Prisms

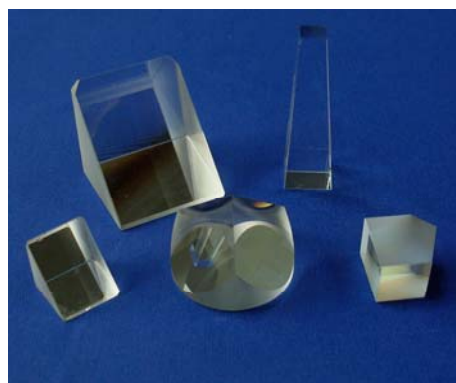
● Prisms

Prisms are blocks of optical material with flat polished sides arranged at precisely controlled angles to each other, which deflect, deviate or rotate beams of light as well as dispersing their wavelength.

We can manufacture many types of prism, each having a particular geometry to achieve the reflections necessary to perform a specific imaging task. Reflecting prisms may invert, rotate, deviate or displace a beam. Dispersing prisms produce spectral separation for spectroscopic applications or for tuning a laser output.

Most of prisms are widely used for laser and commercial applications; hereby we briefly describe six applications of prisms to illustrate the versatility of this optics:

- Beam Turning
- Beam Steering
- Laser Tuning
- Prism Spectrometers
- Evanescent Wave Coupling
- Prisms as Beam Expanders



Right Angle Prism

Right Angle Prisms are precision polished to light tolerances for more demanding applications. They are available in either BK7 or UV Fused Silica. BK7 prisms are recommended for general laboratory use in the visible and near IR. For UV, infrared, or thermally sensitive applications Fused Silica prisms are advised. Our Fused Silica prisms are manufactured to exacting specifications and are useful from 0.16-2.10 μ m.

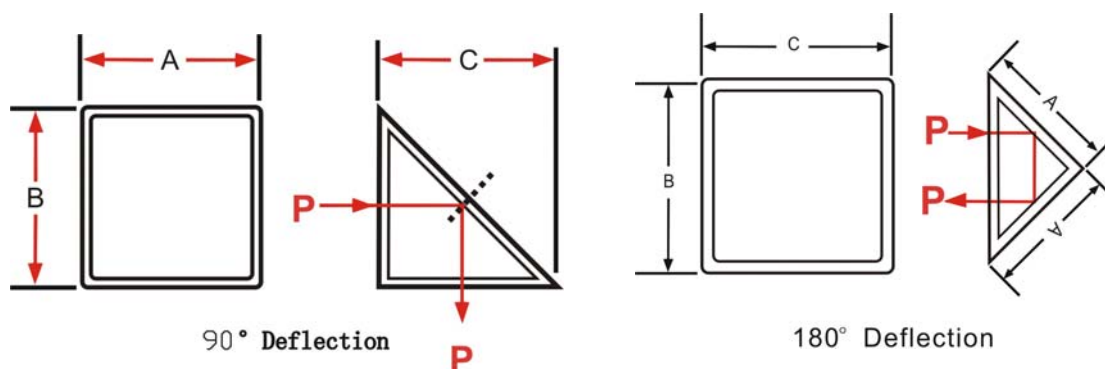
Right angle prism is deviating or deflecting a beam of light with 90° or 180°. It is often used in telescope, periscope and other optical system.



Optical Prisms

● Right Angle Prism

- 90deg Deflection: 90 deg deflection occurs at the face. The hypotenuse image is erected and reversed.
- 180 deg Deflection: 180° deflection uses with hypotenuse as the entrance and exit face. The main application is as a retro-reflector provided that the plane of incident beam includes the vertex.

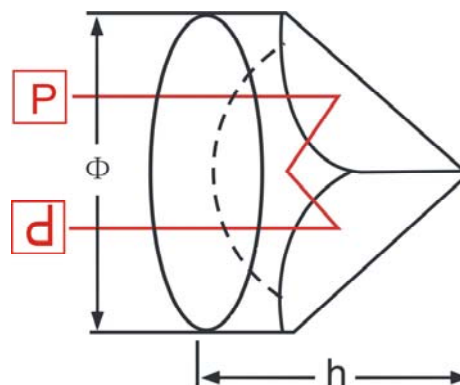


Specifications	Standard	High precision
Material	BK7 grade A, Fused Silica ,Sapphire,Si ,Ge, etc.	
Dimension Tolerance	+0.0, -0.20mm	+0.0, -0.10mm
Surface Quality	60-40 (scratch –dig)	40-20 (scratch –dig)
Surface Figure	$\lambda/4@632.8\text{nm}$	$\lambda/8 @ 632.8\text{nm}$
Deviation	± 3 arc minutes	± 10 arc seconds
Clear Aperture	>85%	>90%
Beve	<0.25mmx45deg.	<0.25mmx45deg.
Coating	Upon requirement	

Optical Prisms

● Corner Cube Prisms

Corner Cube Prism It has three mutually perpendicular surfaces and a hypotenuse face. Light entering through the hypotenuse is reflected by each of the three surfaces in turn and will emerge through the hypotenuse face parallel to the entering beam regardless of the orientation of the incident beam. For its special performance, it is often used to the distance measurement, optical signal process and laser.



Specifications	Standard	High precision
Material	BK7 grade A	
Dimension Tolerance	+0.0, -0.20mm	+0.0, -0.10mm
Surface Quality	60-40 (scratch –dig)	40-20 (scratch –dig)
Surface Figure	$\lambda/4 @ 632.8\text{nm}$	$\lambda/8 @ 632.8\text{nm}$
Deviation	± 5 arc seconds	± 2 arc seconds
Clear Aperture	>85%	>90%
Beve	<0.25mmx45deg.	<0.25mmx45deg.
Coating	Upon requirement	

Note: We will also production Penta Prisms, Dove Prisms, Wedge Prisms, Roof prisms.

Optical Beamsplitters

● Optical Beamsplitters

Beamsplitters are used to split or combine beam of light, The most common types of beamsplitters are plates and cubes. Plates are used for most laser application as they exhibit low absorption. Cubes are a convenient, protected form for low power applications. The performance of beamsplitters are mainly depended on the coating specifications. In selecting beamsplitters, the forms, coating, transmission and damage threshold should be considered.

Beamsplitter Plates

Beamsplitter Plates can be used with high power laser. When using beamsplitter plates, it is important to bear in mind that the two partial beams travel different optical paths. And the optical paths depend on the incident angle and the thickness of plates.

Narrowband Beamsplitter Plates

Specifications:

Material: BK7 grade A optical glass

Dimension Tolerance: +/-0.2mm

Thickness Tolerance: +/-0.2mm

Clear Aperture: >85% of diameter

Parallelism: <1 arc minute

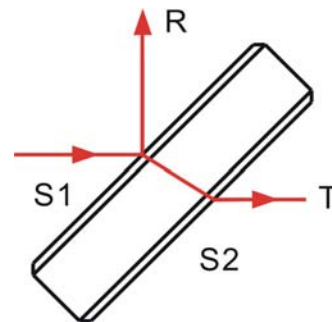
Surface Quality: 60-40 scratch and dig

Flatness: $\lambda/4$ per 25mm @632.8nm

T/R: 50/50±5%, for natural light, $T=(T_s+T_p)/2$, $R=(R_s+R_p)/2$

Coatings: incidence angle 45deg,

S1: Single wavelength partial reflectance, S2: "V" AR-coatings



Broadband Beamsplitter Plates

Specifications:

Material: BK7 grade A optical glass

Dimension Tolerance: +/-0.2mm

Thickness Tolerance: +/-0.2mm

Clear Aperture: >85% of diameter

Parallelism: <1 arc minute

Surface Quality: 60-40 scratch and dig

Flatness: $\lambda/4$ per 25mm @632.8nm

T/R: 50/50±5%, for natural light, $T=(T_s+T_p)/2$, $R=(R_s+R_p)/2$

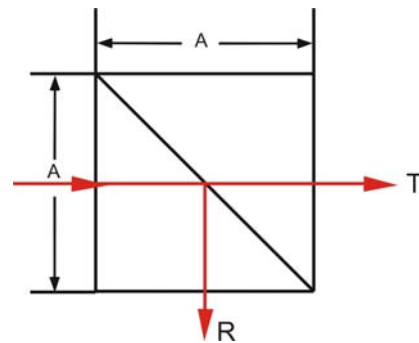
Coatings: incidence angle 45deg,

S1: Broadband partial reflectance, S2: BBAR-coatings

Optical Beamsplitters

● Beamsplitter Cube

Beamsplitter Cube is a more sophisticated type consisting of two right-angle prisms cemented together at their hypotenuse faces. The cemented face of one prism is coated. Before cementing, with a metallic or dielectric layer having the desired reflecting properties, both in the percentage of reflection and the desired color. The absorption loss to the coating is minimal and transmission and reflection approach 50%.



Specifications:

Material: BK7 grade A optical glass

Dimension Tolerance: +/-0.2mm

Surface Quality: 60-40 scratch and dig

Flatness: $\lambda/4$ per 25mm @632.8nm

Angle Tolerance: <3 arc minutes

T/R: 50/50±5%, for natural light, $T=(T_s+T_p)/2$, $R=(R_s+R_p)/2$

Coatings: Partial reflectance: on hypotenuse face ;

AR-coatings: on all input and output faces.

Optical Filters

● Optical Filters

Optical filters are playing more and more important role in light industry and they are widely used in analytical and clinical instruments in life sciences, biotechnology, drug discovery, and industrial markets etc.

Also filters for other various applications, including color imaging, machine vision, process control, photolithography, environmental monitoring and security, are available upon request.

Color Glass Filters

Specifications:

Material: Color glass

Dimension Tolerances: +0, -0.10mm

Thickness Tolerances: ± 0.20 mm

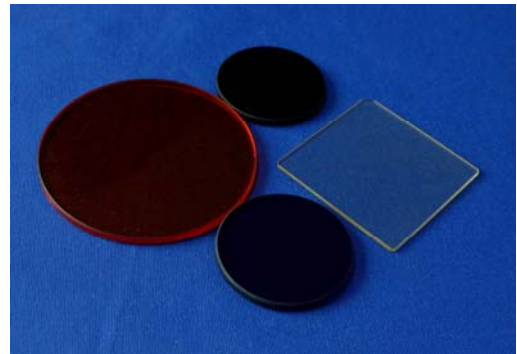
Surface Quality: 60-40 scratch and dig

Flatness: 1λ per 25mm@633nm

Parallelism: 3-5 arc minute

Bevels: < 0.25 mm $\times 45^\circ$

Coating: Upon requirement



Birefringent Filters

Birefringent filter is made by crystal quartz. It's used in the laser cavity for wavelength selection. We can provide different thickness birefringent filter for our customer's laser applications.

Specifications:

Material: Crystal quartz

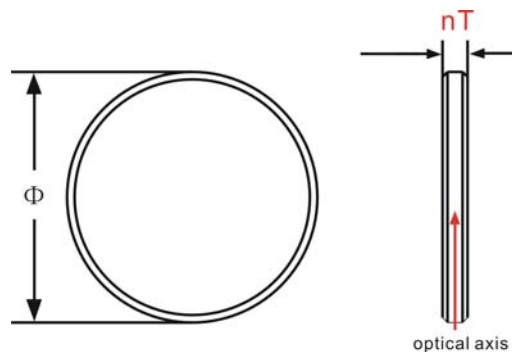
Diameter Tolerance: +0.1, -0.2mm

Thickness Tolerance: ± 0.05 mm

Parallelism: < 5 arc seconds

Surface Quality: 20-10

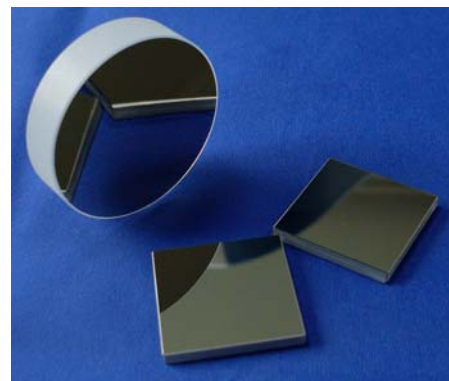
Clear Aperture: 90% of the central area



Optical Mirrors

● Optical Mirrors

Mirrors are used to fold, bend and focus optical beams. They are usually processed into round, rectangle. Other shapes of mirror are available upon your request.



Dielectric Mirrors

Dielectric Mirrors offer near total reflection, minimizing losses in nearly all optical systems. These coatings are very durable, easily cleaned, and resistant to laser damage.

Specifications:

Material: BK7 grade A optical glass

Dimension Tolerance: +/-0.2mm

Clear Aperture: >85%

Parallelism: <1 arc minute

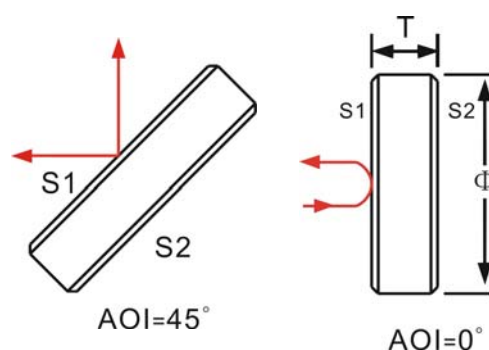
Surface Quality: 40-20 scratch and dig.

Flatness: $\lambda/4$ per 25mm @632.8nm

Coating: AOI=0°, R>99.8%;

AOI=45°, R>99.5% (Rs>99.9%, Rp>99.2%)

Bevel: 0.25mmx45deg



Protected Aluminum

Protected Aluminum for general broadband use, a protected aluminum coating offers the best option. SiO₂ coating is used to protect the delicate aluminum coating, making it suitable for laboratory and industrial use. This coating gives a reflectivity that most closely matches the reflection of a bare aluminum coating: R>87% @400-1200nm.

Specifications:

Material: BK7 grade A optical glass

Dimension Tolerance: +/-0.2mm

Clear Aperture: >85% of diameter

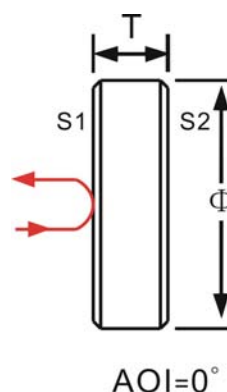
Parallelism: < 1 arc minutes

Surface Quality: 60-40 scratch and dig.

Flatness: $\lambda/4$ @632.8nm

Coating: R> 87% on S1

Bevel: 0.25mmx45deg



ZnS

● ZnS

For windows, domes and lenses for thermal-imaging system. CVD ZnS, which appears orange, mainly works in Far-infrared region

Multi-spectrum ZnS (M-ZnS) shows excellent optical properties across the full band of 0.4-12 μ m, can be used in Far-, Mid-, Near-infrared and visible regions.

CVD ZnS windows, lenses and domes with size up to \varnothing 250 \times 16mm. For M-ZnS, the maximum size is 300 \times 200 \times 15mm



Appellation	Standard CVD ZnS	Multi-Spectral ZnS
Homogeneity of refractive index	$<3 \times 10^{-5}$ @0.6328 μ m	$<3 \times 10^{-5}$ @0.6328 μ m
Hardness(knoop)(kg/mm ²)	210-230	160
Rupture modulus(Mpa)	103.4	68
Young's Modulus(GPa)	74.5	74.5
Poisson ratio	0.29	0.28
Melting point (°C)	1830	1830
Density, (g/cm ³)	4.09	4.09
Thermal conductivity(W/cm.K)	0.19	0.272
Thermal expansion coefficient, (10 ⁻⁶ , °C ⁻¹)	7.85	7.85
Specific heat (Cal/g.k.)	0.112	0.124
Dielectric constant	8.35	8.35

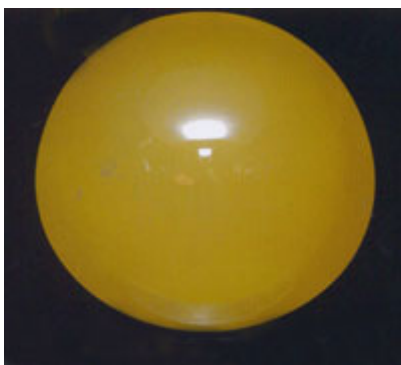
Note: Other special request upon your requirements!

CVD ZnSe

● CVD ZnSe

Primary candidate for high-power CO₂ Lasers windows For windows, domes and lenses for full infrared region devices, especially for high resolution FLIR systems

maximum size: Ø200×12mm; typical size is Ø50×6mm
quality reached American products.



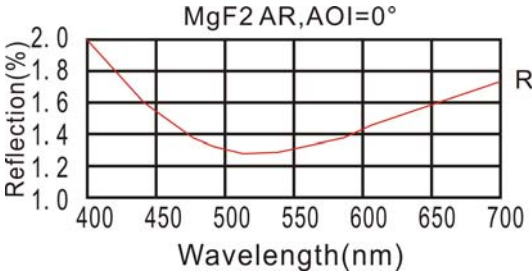
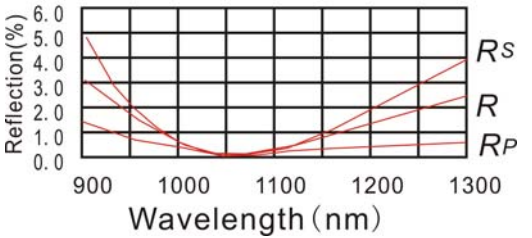
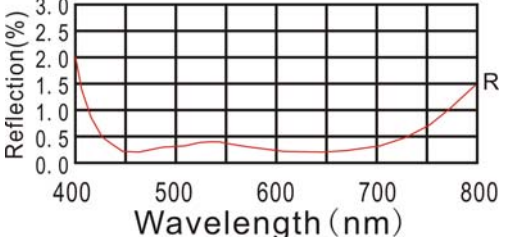
Parameters	CVD ZnSe
Homogeneity of refractive index	$<1 \times 10^{-5} @ 10.6 \mu\text{m}$
Hardness(knoop)(kg/mm ²)	105
Rupture modulus(Mpa)	55
Young's Modulus(GPa)	67.2
Possion ratio	0.28
Melting point (°C)	1520
Density, (g/cm ³)	5.27
Thermal conductivity(W/cm.K)	0.18
Thermal expansion coefficient, (10 ⁻⁶ , °C ⁻¹)	5.75
Specific heat (Cal/g.k.)	0.086
Dielectric constant	8.98

Coatings

● Coatings

Optical coatings are often used to enhance the performance of optical components. They are also used to reflect, absorb, and selectively reflect or transmit light based on wavelength or the state of polarization.

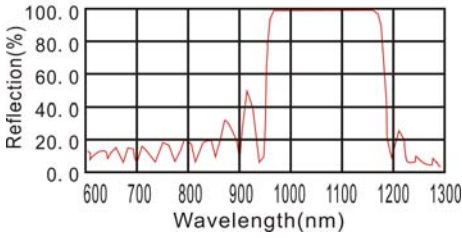
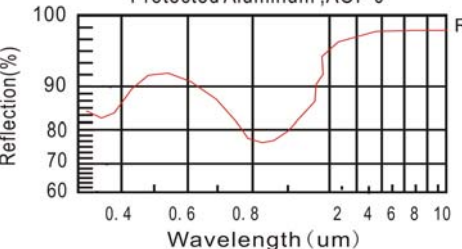
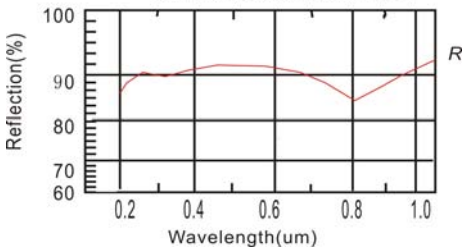
Anti-Reflection (AR) coatings

Spectral Curves	Specifications
 <p>MgF2 AR, AOI=0°</p>	<p>Single layer MgF2 coating</p> <p>Rave < 1.5% @ 540nm R < 2% @ 400~700nm</p>
 <p>"V" AR AOI=0°</p>	<p>"V" Type AR Coating</p> <p>0°: R < 0.2% at center wavelength 45°: R < 0.5% at center wavelength</p>
 <p>Broadband AR AOI=0°</p>	<p>Broadband AR coating</p> <p>0°: R < 0.5% @ 450~650nm 0°: R < 1.0% @ 420~700nm 45°: R < 1.0% @ 450~650nm</p>

Coatings

● Coatings

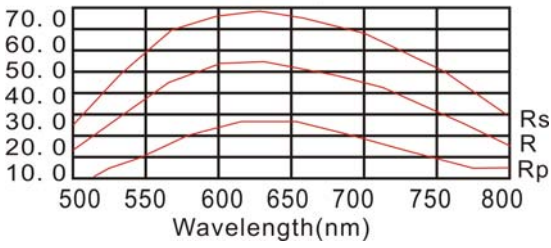
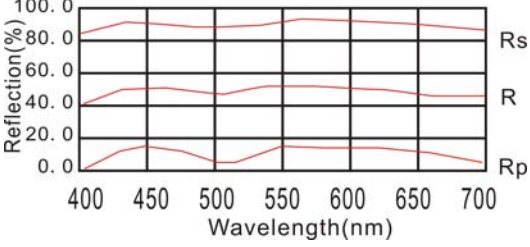
High Reflection (HR) coatings

Spectral Curves	Specifications
<p style="text-align: center;">Dielectric mirror, AOI=0°</p> 	<p>Dielectric mirror coating</p> <p>0°: R<99.8% at center wavelength 45°: R<99.5% at center wavelength (Rs>99.9%, Rp<99.2%)</p>
<p style="text-align: center;">Protected Aluminum, AOI=0°</p> 	<p>Protected Aluminum</p> <p>Ravg>87% @400~1200nm</p>
<p style="text-align: center;">UV Enhanced Aluminum, AOI=0°</p> 	<p>UV Enhanced Aluminum</p> <p>R>80% @200nm</p>

Coatings

● Coatings

Partial Reflection (PR) coatings

Spectral Curves	Specifications
<p style="text-align: center;">Narrowband PR, AOI=45°</p> 	<p>Narrowband partial reflective</p> <p>R= 50.0%±2.0% @632.8nm</p>
<p style="text-align: center;">Broadband PR, AOI=45°</p> 	<p>Broadband partial reflective</p> <p>R=50%±5.0% @450-700nm</p>