VITAL OPTICS TECHNOLOGY CO.,LTD.

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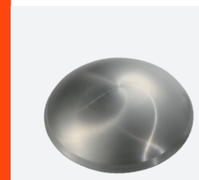
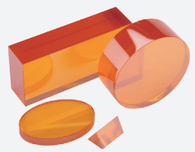
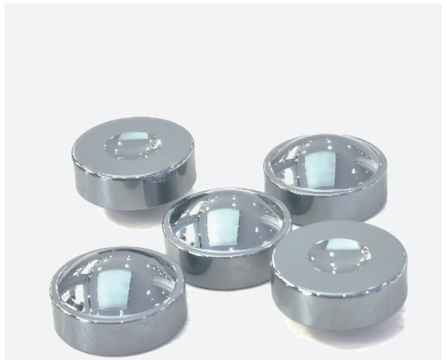
VOT







OPTICAL MATERIALS

PRODUCT BROCHURE

VITAL OPTICS TECHNOLOGY CO.,LTD.

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CORPORATE CULTURE

Mission

To empower humans to perceive the world in more dimensions

Vision

To make the world more intelligent

Values

Respect, Collaboration, Perseverance, Innovation

COMPANY INTRODUCTION

VOT（Vital Optics Technology Co., LTD.） was listed on the Growth Enterprise Market of the Shenzhen Stock Exchange in July 2015, with the stock code: 300489.

VOT is a dedicated national high-tech enterprise specializing in optoelectronic technology, positioning us at the vanguard of innovation in this field. With comprehensive capabilities spanning the entire industry chain, we are capable of full-scale production from the growth of optoelectronic materials, chip design, key sensor manufacturing, to system integration. We offer a diverse range of products and solutions tailored to the needs of the global market: Infrared materials and components, MEMS and detectors, Customized core and lens assemblies, Multifunctional thermal imaging cameras, Tailored integrated optoelectronic systems and solutions.Our product applications span a diverse array of cutting-edge fields: Artificial Intelligence, Semiconductor technology, Advanced materials science, Renewable energy solutions, Medical diagnostics, Sophisticated scientific instruments, Large-scale research equipment, Night vision for outdoor applications, Industrial thermal measurement, Machine vision technology, Internet of Things devices, Environmental monitoring systems, Unmanned Aerial Vehicle payloads, Autonomous driving technologies.

VOT's commitment to innovation and quality ensures that our products meet the rigorous demands of these industries, positioning us as a trusted partner for customers seeking advanced optoelectronic solutions.

Total Number of Employees **2000+**　　Ratio of R&D personnel **26%**

QUALIFICATIONS AND AWARDS

Led by a team of doctoral experts

Applied for 1164 patents

631 patents
Invention patents

498 patents
Utility model patents

35 patents
Design patents

- **ISO 9001:2015** Quality Management System Certificate
- **ISO 14001:2015** Environmental Management System Certificate
- **ISO 45001:2018** Occupational Health and Safety Management System Certificate

CORE TECHNOLOGY

Downstream

Cameras and Systems

03

• Artificial Intelligence

We can provide customers with personalized integrated optoelectronic systems and solutions. We have developed a series of products for different industry applications such as outdoor, security, industrial temperature measurement, intelligent driving, gas detection. With independent intellectual property rights, these products can be applied in scenarios such as outdoor observation, forest fire prevention, gas leakage detection, fire warning, security monitoring, power detection, and warehouse management.

• Uncooled Detector

We have built an 8-inch silicon-based MEMS infrared detector production line, with an annual capacity of 100,000 sets. We have broken through the core technology of infrared thermal imaging. The uncooled detectors have achieved the million-pixel level, with technology at the leading domestic level.

• Cooled Detector

We have completed the construction of 2-6 inch various cooled infrared detector chip production lines (including mid-wave MCT, InSb, mid-wave high-temperature, and long-wave type II superlattice detector chips), matched with self-developed and produced cryocoolers and Dewars, forming a complete cooled infrared detector industry chain covering infrared materials, chips, packaging and end products.

02

Midstream

Core Components

• Crystal Growth

As a leading enterprise in the field of crystal materials, we possess a variety of growth technologies, such as the Czochralski method (CZ), Vertical Gradient Freeze (VGF), Bridgeman method, Chemical Vapor Deposition (CVD), etc., capable of growing high-quality crystals.

Upstream

Photoelectric Materials

01

• Precision Processing

We provide processing, coating, and product inspection services for various components, offering customers a full range of services including material slicing, rolling, milling, polishing, aspheric and bi-element surface processing, and coating. We have a comprehensive quality assurance system and have passed the ISO9001 quality certification, establishing a robust quality management system.

• Infrared Materials

We are one of the few global suppliers capable of producing and mass-supplying Zinc Selenide (ZnSe) materials. Our proprietary 13N ultra-high purity germanium has filled the domestic gap and represents a significant breakthrough in the field of electronic materials.

GLOBAL LAYOUT

7 R&D center

4 Branch

5 Manufacturing Base

- Research and Development Center
- Branch
- Manufacturing Base

OPTICAL MATERIAL

Infrared Optical Materials

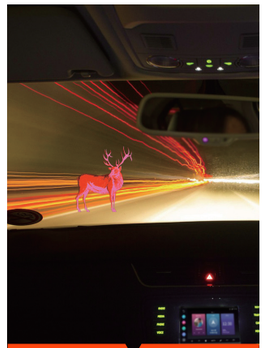
Optical Window Materials

Infrared Optical Materials

VOT focuses on the R&D, production and sales of infrared materials. Our products including Germanium, ZnSe, ZnS, Chalcogenide Glass, GaAs, Silicon, etc. In addition, we provide services for infrared components, including processing, coating, and testing, as well as services including material slicing, rolling, milling, polishing, aspheric and bi-element surface processing, and coating. We possess strong R&D capabilities and extensive customer service experience, serving many important customers in Europe and America, with product quality widely recognized by customers in China and abroad.

- Ge
- ZnSe
- ZnS
- Chalcogenide Glass
- Silicon
- GaAs
- GaSb
- InSb
- InAs
- CZT

Application Fields

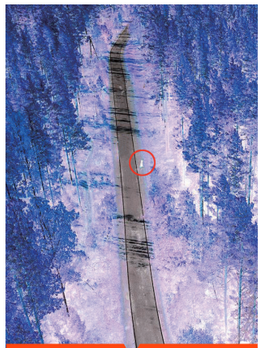


Automotive

Automotive night vision systems utilize thermal imaging technology to visualize the contours of people and objects in dark or inclement weather. When road conditions cannot be reliably recognized by human eyes in fog, dust, smoke, and rainstorms situation, automotive night vision allows the driver to identify objects, slow down and brake in advance, enable them to

Unmanned Aerial Vehicle

Equipped with infrared technology, UAVs can carry out effective reconnaissance and surveillance tasks under various environmental conditions, quickly search large areas, locate targets and conduct continuous tracking. They can be widely applied in fields such as border patrol, search and rescue, agricultural monitoring, power inspection, geological exploration, etc.



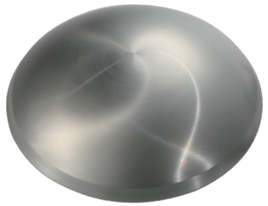
Security

Thermal imaging cameras provide the ability to see through smoke, fog, rain, and dust with a visual range of up to several kilometers, making them ideal in fields such as border control, intelligent surveillance, smart city, forest fire prevention applications.

Industry

In industry, thermal imaging cameras can be used as a detecting system for operating power equipment, industrial pipelines, machinery and equipment. The workers can quickly, safely and easily find potential problems of the key equipment. The cameras help saving time and costs, avoiding fire and other accidents.

Germanium



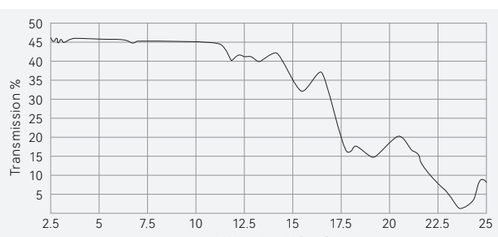
Germanium features high refractive index, wide infrared transmission range, low absorption coefficient, low dispersion, and is easy to process.Germanium is the most commonly used material for producing IR optical lenses and IR optical windows. Due to its excellent transmittance in the infrared spectrum and opacity in the visible spectrum, Germanium is highly suitable for fabricating optical components used in infrared lasers and thermal imaging applications. It can be used as a material for windows, lenses, prisms, and filters for thermal imagers and infrared radar, and in other infrared optical devices used in critical civilian applications.

Product Specifications

Physical Properties	
Crystal Growth	CZ
Crystal Structure	Monocrystalline/Polycrystalline
Purity	≥6N
Conduction Type	n
Resistivity	5~40Ω·cm 1~5Ω·cm >50Ω·cm
Surface Finish	Ra_{max}0.2μm to 4.0μm(D7 to D46)

Formats/Sizes	
Circular Disks	Monocrystalline: ~300mm, Polycrystalline: ~450mm Thickness: >0.5mm
Rectangular Sheets	LengthxWidth:~350x350mm Thickness: >0.5mm Parallelism: <0.03mm
Lenses (Spherical/Aspherical)	Diameter: 5~270mm ETV: <0.03mm
Other Shapes	Available on request
Tolerance	Roughness: 0.2~0.4μm

Optical Properties	
Transmission Spectrum	2~14μm
Coefficient of Refractive index (dn/dt)	$400x10^{-6}K$
Refractive Index 10.6μm	4.0046
Refractive Index Homogeneity	$≤1.0+10^{-4}$
Absorption Coefficient,10.6μm,(/cm)	≤ $0.035cm^{-1}$
Optical Transmission,10.6μm	>46%



Wavelength, (μm)	Refractive Index
2	4.1097
3	4.0455
4	4.0255
5	4.0165
6	4.0117
7	4.0087
8	4.0069
9	4.0055
10	4.0046
11	4.0038
12	4.0032
13	4.0027

13N High Purity Germanium

The high-purity germanium detector, which is using high-purity germanium crystal as the detection medium, has the advantages of superior energy resolution, wide energy measurement range, and high detection efficiency. It has a broad application prospect in the fields of dark matter detection, nuclear power, material science, trace element analysis and security inspection. VOT is committed to continuously innovating and developing the production technology of the high-purity germanium crystal and detector, and provides customers with the best solutions.

Product Specifications

Product Highlights		Transport Properties – Hall mobility μH
Net Carrier Concentration	$<2x10^{10}cm^{-3}$	p-type μH: ≥10 000 $cm^2/V.s$ (Central measurement) n-type μH: ≥10 000 $cm^2/V.s$ (Central measurement)

Deep Level (measured by DLTS)

p-type: Cu_{tot} ≤$4.5x10^9cm^{-3}$

n-type: Deep level point defects <$5x10^8cm^{-3}$

Crystallographic Perfection	p-type	n-type
Dislocation density (EPD, cm^{-2})	≤10 000	≤5 000
Lineage (unit length = slice radius)	≤4	≤3
Mosaic structures (unit surface = $10mm^2$)	≤6	≤3
Saucers (cm^{-2})	≤500	≤500

Fiber Grade $GeCl_4$

Ordinary $GeCl_4$ is the raw material for producing GeO_2, fiber grade $GeCl_4$ is an imporrant dopant in the production of optical fiber preforms. Its role is to increase the refractive index of the core, thereby enabling lossless transmission of light.

Product Specifications

Standard: Purity ≥99.999999%

Metal Impurities	Specifications	Metal Impurities	Specifications
$GeCl_4$(%)	99.999999	Ni(ppb)	≤0.5
Cr(ppb)	≤0.5	V(ppb)	≤0.5
Fe(ppb)	≤1	Al(ppb)	≤0.5
Co(ppb)	≤0.5	Zn(ppb)	≤0.5
Cu(ppb)	≤0.25	Pb(ppb)	≤0.5
Mn(ppb)	≤0.5		

Impurity Absorption Peak Infrared Transmittance	
3608cm^{-1} ($GeCl_3OH$)	>93.0%
2970~2925cm^{-1} (CH)	>98.0%
2860~2830cm^{-1}(HCl)	>99.0%
2336±2cm^{-1}(CO_2)	>97.0%
2272±2cm^{-1}($GeHCl_3$)	>98.0%
2000~1400cm^{-1}	>95.0%
1173cm^{-1}	>95.0%
1015~1060cm^{-1}	No peaks

High Purity: Purity ≥99.999999%

Metal Impurities	Specifications	Metal Impurities	Specifications
$GeCl_4$ (%)	99.999999	Ni (ppb)	≤0.5
Cr (ppb)	≤0.5	V (ppb)	≤0.5
Fe (ppb)	≤1	Al (ppb)	≤0.5
Co (ppb)	≤0.5	Zn (ppb)	≤0.5
Cu (ppb)	≤0.25	Pb (ppb)	≤0.5
Mn (ppb)	≤0.5		

Impurity Absorption Peak Infrared Transmittance	
3608cm^{-1} ($GeCl_3OH$)	>97.0%
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1173cm^{-1}	>98.0%
1015~1060cm^{-1}	No peaks

Packaging

1kg/bottle, 50kg/bottle, 100kg/bottle, 200kg/bottle, 400kg/bottle
(Customizable packaging)

GeO_2

GeO_2 is widely used in the manufacture of high-purity metallic Ge, organic Ge, BGO, $GeCl_4$ for optical fiber, chemical catalysts, the pharmaceutical industry, PET resins, and electronic devices, etc.

Soluble GeO_2 has good stability and transparency and is widely used in the production of PET (Polyethylene Terephthalate) resins. PET resins can be used in fields such as food, wine, and cosmetics containers.

Product Specifications

Determination	Specifications	Typical Value
Appearance	White Powder	Qualified
Purity	99.9999%	Qualified
Moisture	≤0.5%	≤0.5%

Determination	Specifications	Typical Value
Loss on Ignition	≤0.2%	≤2%
Chlorine Content	≤0.05%	≤0.05%
Loose Bulk Density	1.3~1.8g/m^3	1.3~1.8g/m^3

		Specifications	Typical Value
Impurities	As	≤1.0x10^{-5}	1.0x10^{-5}
	Fe	≤1.0x10^{-5}	1.0x10^{-5}
	Cu	≤1.0x10^{-6}	1.0x10^{-6}
	Ni	≤2.0x10^{-6}	2.0x10^{-6}
	Pb	≤2.0x10^{-6}	2.0x10^{-6}
	Ca	≤2.0x10^{-5}	2.0x10^{-5}
	Mg	≤1.0x10^{-5}	1.0x10^{-5}

		Specifications	Typical Value
Impurities	Si	≤2.0x10^{-5}	2.0x10^{-5}
	Co	≤2.0x10^{-6}	2.0x10^{-6}
	In	≤1.0x10^{-6}	1.0x10^{-6}
	Zn	≤1.5x10^{-5}	1.5x10^{-5}
	Al	≤1.0x10^{-5}	1.0x10^{-5}
	Total Content	≤1.0x10^{-4}	1.0x10^{-4}

Packaging

1kg/bottle, 5kg/bag, 25kg/drum
(Customizable packaging)

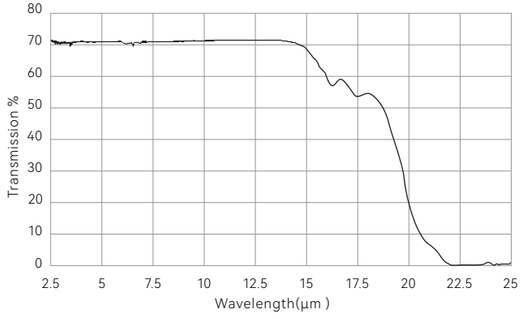
ZnSe

ZnSe is an optical material featuring high purity, strong environmental adaptability, ease of processing. ZnSe is widely used in laser and infrared thermal imaging systems. It possesses low light transmission loss and excellent transmission properties. ZnSe has a low absorption rate at 10.6 microns, making it the preferred material for high-power CO_2 laser optical components. ZnSe is also used in various focusing mirrors, window materials, output coupling, and beam expanders.Due to its excellent optical properties, it has become a commonly used material for various optical systems. It is widely used in fields such as lasers, medicine, astronomy, and infrared night vision.Leveraging its world-class technology and years of manufacturing experience, VOT supplies high quality ZnSe blanks and optical lenses to many well-known international companies.

Product Specifications

Physical Properties	
Crystal Growth	CVD
Crystal Structure	Polycrystalline
Particle Size	≤100μm
Purity	5N
Grade	Infrared, laser, low power

Optical Properties	
Transmission Spectrum	0.5~22μm
Max Transmittance,10.6μm	≥70%
Absorption Coefficient,10.6μm	≤ 0.0005cm^{-1}
Refractive Index Inhomogeneity @0.6328μm	3X10^{-6}
Refractive Index,10μm	2.4070
Coefficient of Refractive index (dn/dt) ,(10.6μm)	6.1x10^{-5}/℃



Formats/Sizes	
Circular Disks	Diameter: ~450mm, Thickness: ~50mm Cylineders can be polished
Rectangular Sheets	LengthxWidth: ~450x450mm Thickness: ~50mm
Lenses (Spherical/Aspherical)	Diameter: ~400mm
Other Shapes	Available on request
Tolerance	Roughness: ≤1μm, Roundness: ≤0.03mm

Wavelength (μm)	
2	2.4467
3	2.4380
4	2.4336
5	2.4300
6	2.4263
7	2.4223
8	2.4178
9	2.4127
10	2.4070
11	2.4006
12	2.3935
13	2.3857
14	2.3768

ZnS

ZnS can be divided into raw ZnS and multispectral ZnS. Multispectral ZnS is grown by the chemical vapor deposition (CVD) process. Multispectral ZnS is obtained from native ZnS through a hot isostatic pressing treatment. ZnS has a transmission range covering visible and infrared light. Multispectral ZnS features high hardness and strong resistance to wind and sand erosion, and is widely applied in the manufacture of IR windows and IR optical components.

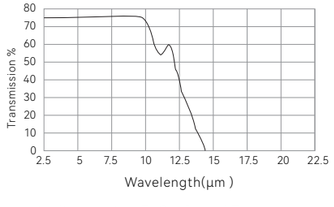
Product Specifications

Specification	
Crystal Growth	CVD
Grade	Raw ZnS, Multispectral ZnS
Purity	5N

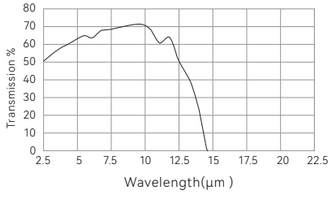
Optical Properties	Raw ZnS	MS ZnS
Transmission Spectrum	0.45~14μm	0.38~14μm
Volume absorption coefficient 10.6μm	≤0.24cm^{-1}	≤0.20cm^{-1}
Coefffcient of refractive index	<41X10^{-6}/℃ @10.6μm	<54X10^{-6}/℃ @0.6328μm
Refractive Index Inhomogeneity	<100X10^{-6} @10.6μm	<20X10^{-6} @0.6328μm

Formats/Sizes	
Circular Disks	Diameter: ~450mm Thickness: ~50mm Roundness: ≤0.03μm Cylineders can be polished
Rectangular Sheets	LengthxWidth: ~500x500mm Thickness: ~50mm
Lenses (Spherical/Aspherical)	Diameter: ~400mm, Roundness: ≤0.03μm

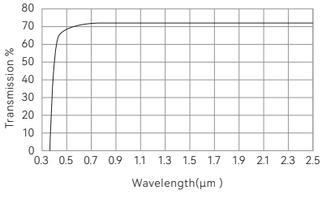
Wavelength (μm)	Raw ZnS	MS ZnS
1	2.2921	2.2926
2	2.2655	2.2662
3	2.2578	2.2577
4	2.2521	2.2523
5	2.2467	2.2466
6	2.2395	2.2391
7	2.2321	2.2328
8	2.2234	2.2233
9	2.2121	2.2129
10	2.2005	2.2008
11	2.1867	2.1892
12	2.1765	2.1710
13	2.1523	2.1525
14	2.1305	2.1301
15	2.1065	2.1068
16	2.0789	2.0782



Multi-spectral ZnS Infrared Transmission



Raw ZnS Infrared Transmission



Multi-spectral ZnS Visible Light Transmission

Chalcogenide Glass

Chalcogenide glass features superior refractive index uniformity and stability, making it an ideal optical material for chromatic aberration correction of infrared optical lenses and avoidance of thermal defocus in the range of 2~12 μm. At the same time, due to its low thermal transition temperature and stable chemical properties, chalcogenide glass can be processed using precision molding, facilitating large-scale mass production. Chalcogenide glass is mainly used in monitoring equipment and systems as well as marine/maritime, fire/police, sensors and infrared products. VOT produces high-purity, high-uniformity chalcogenide glass with various compositions and sizes, including Ge-As-Se, Ge-Sb-Se, and As-Se products. Chalcogenide glass can be processed using a variety of means to produce flat, spherical, and aspherical products through molding, machining, and polishing.

Product Specifications

Formats/Sizes	
Circular Disks	Diameter: ~400mm, Roughness: Rq<0.2μm, ETV<0.03mm
Lenses (Spherical/Aspherical)	Diameter: ~150mm, Roughness: Rq<0.5μm, Parallelism: <0.03mm

Properties

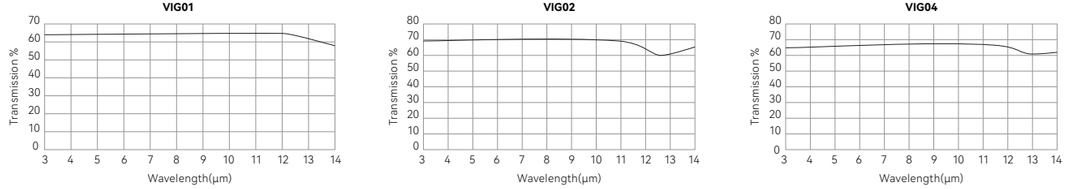
	VIG 01 $Se_{63}As_{30}Sb_4Sn_3$	VIG 02 $Ge_{33}As_{12}Se_{55}$	VIG 04 $Ge_{10}As_{40}Se_{50}$	VIG 05 $Ge_{28}Sb_{12}Se_{60}$	VIG 06 $As_{40}Se_{60}$	VIG 07 $Ge_{20}Sb_{15}Se_{65}$	VIG 08 $Ge_{22}As_{20}Se_{58}$	VIG 09
Coefficient of Refractive Index (dn/dT) ,x$10^{-6}K^{-1}$	18.6	67	20	60.5	30.9	37	58.2	166

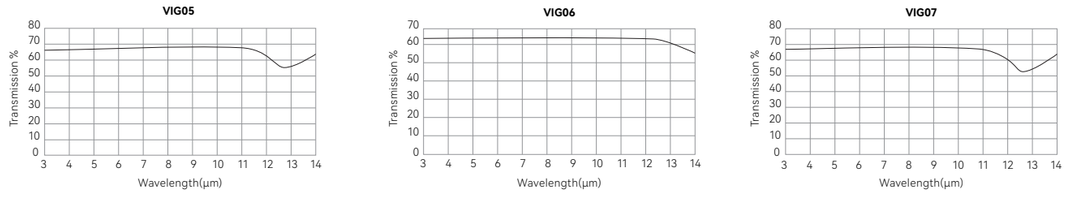
Refractive Index

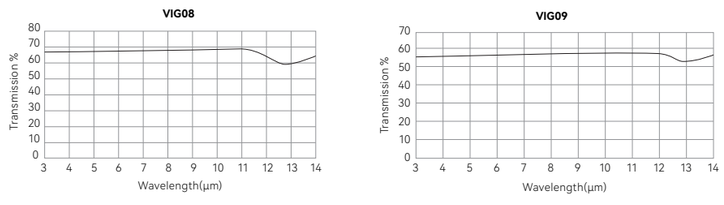
λ/μm	VIG 01 $Se_{63}As_{30}Sb_4Sn_3$	VIG 02 $Ge_{33}As_{12}Se_{55}$	VIG 04 $Ge_{10}As_{40}Se_{50}$	VIG 05 $Ge_{28}Sb_{12}Se_{60}$	VIG 06 $As_{40}Se_{60}$	VIG 07 $Ge_{20}Sb_{15}Se_{65}$	VIG 08 $Ge_{22}As_{20}Se_{58}$	VIG 09
2	2.8086	2.5299	2.6413	2.6412	2.8193	2.6256	2.5268	3.2184
3	2.7923	2.5179	2.6272	2.6264	2.8011	2.6107	2.5150	3.1903
4	2.7851	2.5130	2.6218	2.6206	2.7943	2.6040	2.5103	3.1755
5	2.7802	2.5103	2.6189	2.6171	2.7905	2.6010	2.5074	3.1684
6	2.7781	2.5075	2.6167	2.6142	2.7878	2.5976	2.5050	3.1643
7	2.7747	2.5051	2.6145	2.6113	2.7853	2.5945	2.5026	3.1612
8	2.7731	2.5024	2.6126	2.6084	2.7831	2.5914	2.5002	3.1586
9	2.7713	2.4993	2.6106	2.6054	2.7805	2.5885	2.4976	3.1564
10	2.7678	2.4962	2.6084	2.6019	2.7779	2.5851	2.4946	3.1542
11	2.7639	2.4924	2.6059	2.5982	2.7750	2.5813	2.4914	3.1519
12	2.7621	2.4885	2.6034	2.5944	2.7717	2.5765	2.4877	3.1497

Transmittance

%	VIG 01 $Se_{63}As_{30}Sb_4Sn_3$	VIG 02 $Ge_{33}As_{12}Se_{55}$	VIG 04 $Ge_{10}As_{40}Se_{50}$	VIG 05 $Ge_{28}Sb_{12}Se_{60}$	VIG 06 $As_{40}Se_{60}$	VIG 07 $Ge_{20}Sb_{15}Se_{65}$	VIG 08 $Ge_{22}As_{20}Se_{58}$	VIG 09
2.5	64.08	70.05	65.42	66.34	64.63	68.54	67.19	56.58
3	63.78	69.61	65.14	65.92	64.09	68.03	66.76	56.93
4	64.11	69.62	65.48	66.32	64.30	67.99	66.93	57.47
5	64.05	69.03	65.57	66.16	64.20	67.75	67.07	57.44
6	64.11	69.45	65.82	66.68	64.07	67.73	67.44	57.61
7	64.24	69.45	65.89	66.79	64.00	67.73	67.44	57.78
8	64.36	69.22	66.35	66.98	64.02	67.41	67.93	57.89
9	64.55	69.51	66.92	67.72	64.18	67.80	68.67	58.35
10	64.64	69.56	67.14	67.90	64.15	67.82	68.91	58.43
11	64.69	68.96	66.97	67.35	64.12	67.06	68.52	58.57
12	64.66	64.04	65.10	62.22	63.90	61.15	64.38	58.32
12.5	63.82	60.03	62.46	55.92	63.18	53.69	59.81	56.58
13	61.73	60.47	61.38	55.83	60.95	54.36	60.26	54.53
14	57.60	64.86	62.05	63.40	56.32	63.89	64.32	57.28
8-12	64.58	68.26	66.50	66.43	64.07	66.25	67.68	58.31





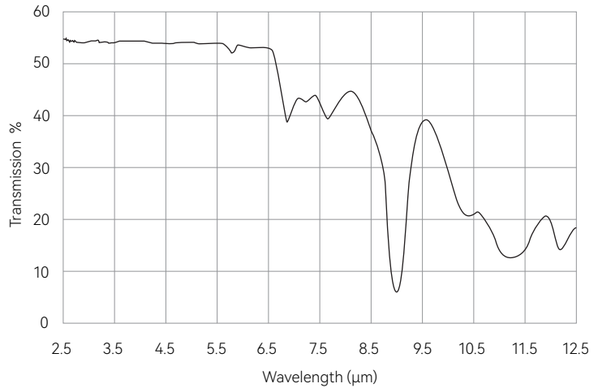


Silicon

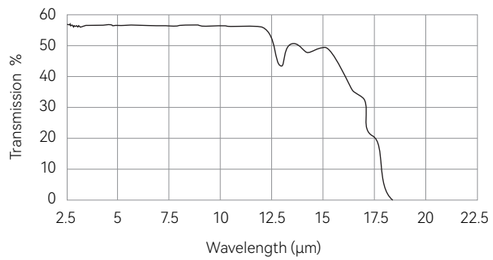
Silicon is commonly used as an IR reflector and window material in the 1.5 ~8 micron range. As one of the most widely used infrared materials, silicon has characteristics such as good durability, high thermal conductivity, and low density. It is extensively applied in infrared windows for optoelectronic components. VOT's silicon products include silicon wafers, blank lenses. VOT is positioned to offer both FZ and CZ Grades of silicon based on your particular requirements.

Product Specifications

Wavelength (μm)	Refractive Index
2	3.4516
3	3.4321
4	3.4257
5	3.4223
6	3.4202
7	3.4189
8	3.4184
9	3.4181
10	3.4179
11	3.4176



GaAs



High purity GaAs single crystals produced by the vertical gradient freeze (VGF) growth method, after cutting, grinding, and polishing, can reach ≥55% transmittance in the 2~12μm infrared band. In case of relatively thick products (≥3 mm), the transmittance will gradually decrease as the thickness increases, generally around 51% to 55%. GaAs can be used in practical applications where the strength and stiffness of the IR material are critical factors, and can also be used in CO_2 laser applications as an alternative to ZnSe optical lenses or mirrors.

GaSb

GaSb is a very important III-V group direct bandgap semiconductor material with a bandgap width of 0.72eV, which it is an ideal substrate for the development of Class II superlattice detectors and mid-infrared band lasers.

Product Specifications

Wafer Specifications			
Slice diameter	2″	3″	4″
Orientation	(100) ±0.1°	(100) ±0.1°	(100) ±0.1°
Diameter (mm)	50.5±0.5	76.2±0.4	100.0±0.5
Flat option	EJ	EJ	EJ
Flat tolerance	±0.1°	±0.1°	±0.1°
Main flat length (mm)	16±2	22±2	32.5±2.5
Minor flat length (mm)	8±1	11±1	18±1
Thickness (μm)	500±25	625±25	1000±25

Wafer dimension can be customized upon request.

Electrical and Dopant Specifications				
Dopant	type	carrier concentration cm^{-3}	mobility $cm^2 V^{-1} S^{-1}$	E.P.D cm^{-2}
Undoped	p-type	≤$2x10^{17}$	>500	2″, 3″, 4″≤1000
Te-doped	n-type	(0.5~9)$x10^{17}$	3500~2000	2″, 3″, 4″≤1000

Stricter electrical specifications are available on request.

Flatness specifications				
Wafer Form		2″	3″	4″
Polished/ Etched	TTV(μm)	<8	<8	<10
	Bow(μm)	<8	<8	<10
	Warp(μm)	<12	<12	<15
Polished/ Polished	TTV(μm)	<5	<5	<5
	Bow(μm)	<5	<5	<5
	Warp(μm)	<8	<8	<10

InSb

Indium Antimonide (InSb), as a kind of III-V semiconductor crystal material, has a very narrow band gap a very small effective mass of electrons and a very high electron mobility, which has gained important applications in the field of magnetoresistive components and Hall devices and other industrial technologies. InSb-based infrared detectors have very high quantum efficiency and response rate in the 3~5μm band, which makes it the preferred material for mid-wave infrared detectors.

Product Specifications

Wafer Specifications		
Slice diameter	2″	3″
Orientation	(111) A or B ± 0.1° The crystal orientation(100) can also be provided at an arbitrary angle away from the growth plane(100)	
Diameter (mm)	50.5±0.5	76.2±0.4
Flat option	2 Flats at 120°	2 Flats at 120°
Flat tolerance	±0.1°	±0.1°
Major flat length (mm)	16±2	22±2
Minor flat length (mm)	8±1	11±1
Thickness (μm)	625±25	800 or 900±25

Wafer dimension is available upon request.

Electrical and Dopant Specifications				
Dopant	type	carrier concentration cm^{-3}(77K)	mobility $cm^2 V^{-1} S^{-1}$	E.P.D cm^{-2}
Te-doped	n-type	$4x10^{14}$~$1.4x10^{15}$	≥$1x10^5$	2″, 3″≤50

Stricter electrical specifications are available on request.

Flatness specifications			
Wafer Form		2″	3″
Polished/ Etched	TTV(μm)	<10	<10
	Bow(μm)	<10	<10
	Warp(μm)	<15	<15
Polished/ Polished	TTV(μm)	<5	<5
	Bow(μm)	<5	<5
	Warp(μm)	<8	<8

InAs

InAs single crystals can be used as the substrates for the growth of InAsSb/InAsPSb, InNAsSb, heterojunction and InAs/GaSb superlattice structure, which can be used to produce infrared light-emitting devices with the wavelengths of 2~14μm, and mid-infrared quantum cascade lasers, and these infrared devices have a good prospect of application in the field of gas monitoring and low-loss fiber communication. In addition, InAs single crystals has electron mobility, which is an ideal material for Hall devices.

Product Specifications

Wafer Specifications			
Slice diameter	2″	3″	4″
Orientation	(100) ±0.1°	(100) ±0.1°	(100) ±0.1°
Diameter (mm)	50.5±0.5	76.2±0.4	100.0±0.5
Flat option	EJ	EJ	EJ
Flat tolerance	±0.1°	±0.1°	±0.1°
Major flat length (mm)	16±2	22±2	32.5±2.5
Minor flat length (mm)	8±1	11±1	18±1
Thickness (μm)	500±25	625±25	1000±25

Wafer dimension is available upon request.

Electrical and Dopant Specifications				
Dopant	type	carrier concentration cm^{-2}	mobility $cm^2 V^{-1} S^{-1}$	E.P.D cm^{-2}
Te-doped	p-type	(1~3) $x10^{-18}$	>20000	3″, 3″, 4″≤1000

Stricter electrical specifications are available on request.

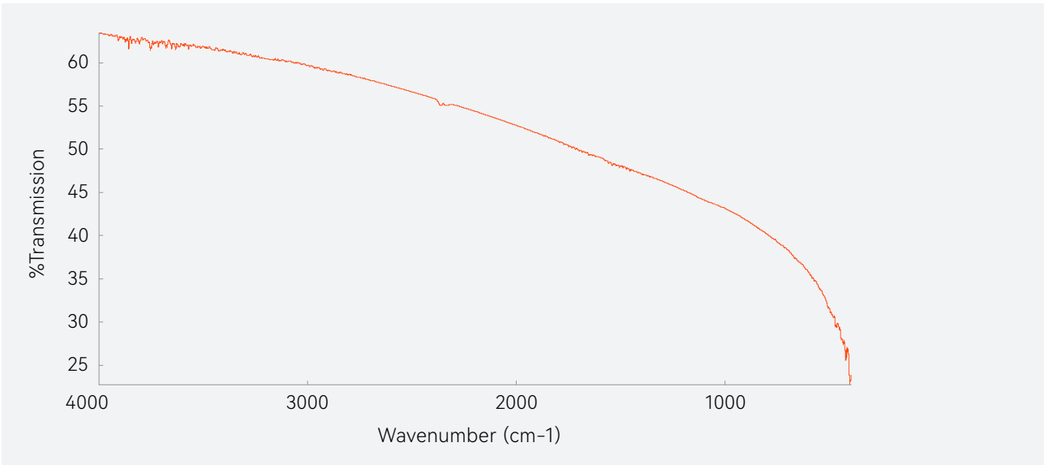
Flatness specifications				
Wafer Form		2″	3″	4″
Polished/ Etched	TTV(μm)	<10	<10	<15
	Bow(μm)	<8	<8	<10
	Warp(μm)	<12	<12	<15
Polished/ Polished	TTV(μm)	<5	<5	<5
	Bow(μm)	<5	<5	<5
	Warp(μm)	<8	<8	<10

CZT

Cadmium Zinc Telluride single crystal (Cd1-xZnxTe, CZT) is a wide-band II-VI compound semiconductor, which can be regarded as solid solution of CdTe and ZnTe, with sphalerite structure at room temperature and pressure, belonging to the cubic crystal system. Its melting point varies from 1092℃ and 1295℃ depending on the Zn content. Its lattice constant can be modulated by changing the Zn composition, and it can perfectly match with the narrow-band HgCdTe material in the lattice, so it can be used as the preferred substrate material for HgCdTe epitaxy. Cadmium Zinc Telluride has been widely used in the preparation of high-performance infrared focal plane detectors.

Product Specifications

$Cd_{0.96}Zn_{0.04}Te$			
Thickness dimension tolerance	Thickness tolerance ±50μm Dimension tolerance±100μm	Dislocation density	<1x10⁵/cm²
Crystal orientation	(111) The deviation of crystal direction is not more than 0.2°	Flatness	≤5μm
Surface quality	No scratches,no point defects with in the planar array and no chipping in the microscopic inspection	Roughness	≤1nm
Internal defect	Uniformity of substrate appearance	Transmittance	>55%
Sedimentary phase	<10μm	Half-peak width	≤40″
		Component	0.036 ~ 0.06
		Size	Can be customized upon request



Optical Window Crystals

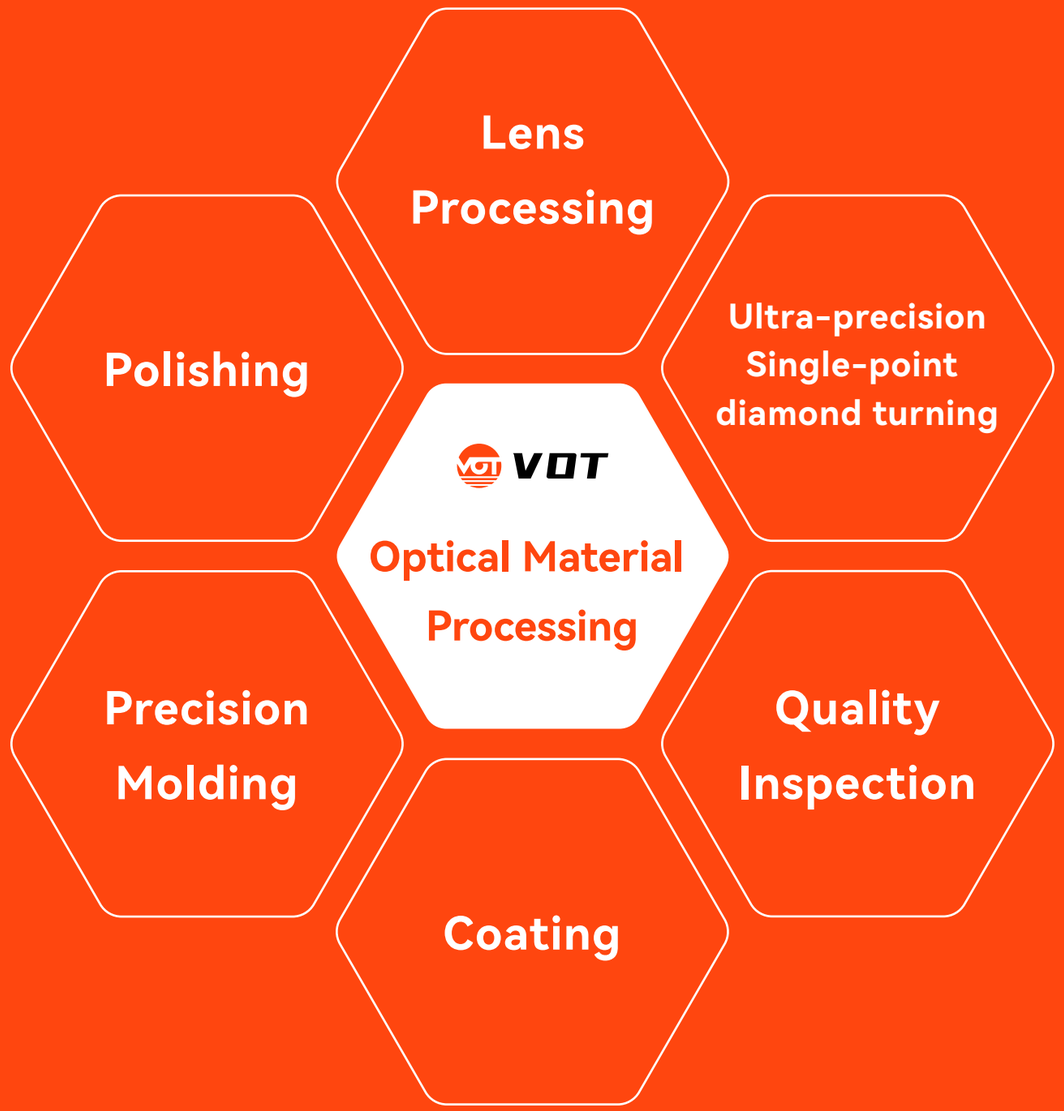
VOT can grow ideal crystal materials for manufacturing various optical windows, prisms, lenses, and other optical elements, such as sapphire (Al_2O_3), calcium fluoride (CaF_2), magnesium fluoride (MgF_2) , barium fluoride (BaF_2), etc.

Product Specifications

	Al_2O_3	CaF_2	MgF_2	BaF_2
Density (g/cm³)	3.98	3.18	3.18	4.89
Melting Point (℃)	2050	1402	1255	1280
Transmittance range (μm)	0.19 ~ 5.2	0.13 ~10	0.11 ~ 7.5	0.13 ~ 12.5
Refractive Index	1.76	1.6921~1.3161	n_o=1.37608 n_e=1.38771	1.5122~1.3703
Thermal Conductivity ($Wm^{-1}K^{-1}$)	25.12	9.71	0.3	11.72

Optical Material Processing

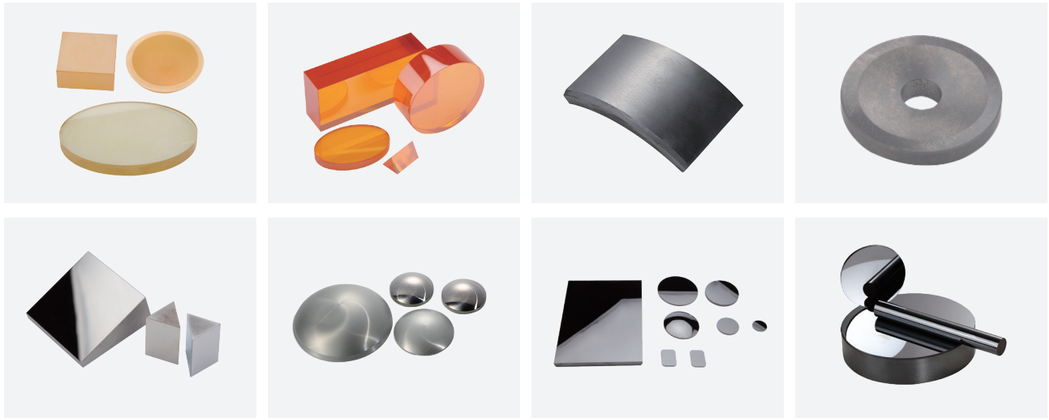
Core technology driving the substantial growth of the infrared industry.



Lens Processing

Processing Technology: Various infrared materials, square pieces, round pieces, lenses, special-shaped pieces, domes, etc.
Main processing materials: Ge, ZnSe, Chalcogenide glass, Silicon, ZnS, GaAs, etc.
High-precision Processing Equipment: Five-axis CNC machining center, CNC lathe, wire cutting equipment, vertical milling and grinding equipment, etc.

Industry Level: VOT excels in processing various specifications of optical lenses, with processing capabilities at the industry-leading level.



Dimensional Parameters		
Round Discs	~600mm	Surface Roughness: Ra<0.5μm
Square Discs	Length × Width: 4x4mm~600x600mm, Thickness Range: >0.5mm, Parallelism: <0.03mm	
Lenses	Diameter Range: ~400mm, ETV<0.01mm	
Special-shaped Slices	Sectors, Prisms, and Various Customer-Specified Shapes	
Domes	Diameter ~400mm	

Polishing

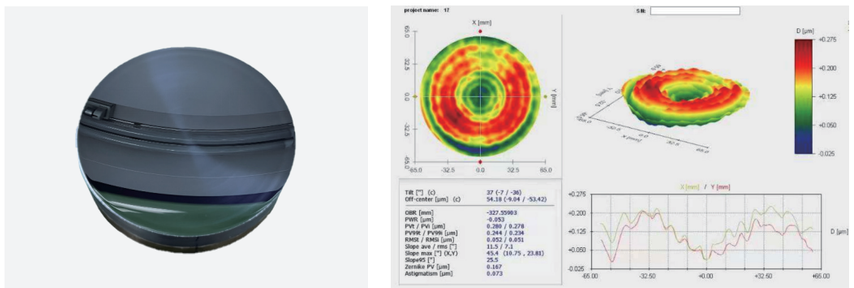
VOT has High-speed, classical and aspheric polishing line, capable of mass-producing high-precision products, covering different product types such as lenses, plane mirrors, preform, special-shaped pieces, ultra-thin mirrors, cylindrical mirrors, domes, etc.

Industry Level: VOT excels in producing various types of high-precision polished products, with capabilities at the industry-leading level.

Polishing Material Parameters	
Polishing Materials	Ge, ZnSe, ZnS, CaF2, BaF2, Chalcogenide Glass, and other infrared materials.
Size	~450
Parallelism	0.01~0.02mm
Power	0.5fri
Irregularity	0.5fri
S/D	60/40、40/20、20/10

Aspheric CNC

The equipment used for Aspheric CNC is the German Satisloh SPS-200 CNC polishing machine, which can process products as shown in the table below.



Product Parameters	
Main Polished Lenses	Materials: Silicon, Zinc Selenide, Zinc Sulfide, etc.
Diameter	<260mm
PV	<0.5μm
RMS	0.050μm
S/D	60/40

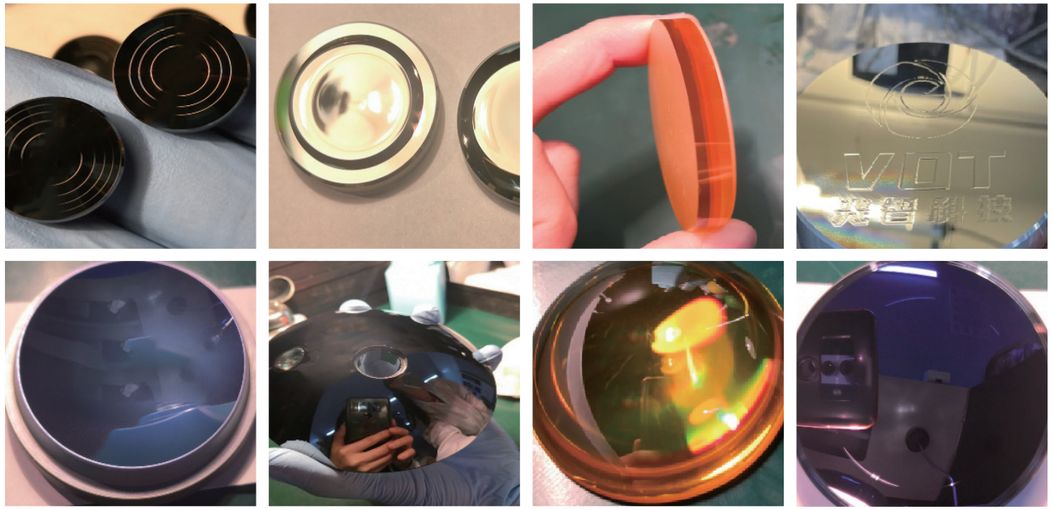
Ultra-precision Single-point diamond turning

- Rapid response to market demands.
- Ultra-high precision Aspheric processing.
- Ultra-precision diffraction surfaceprocessing.
- Ultra-precision arrays, cylindrical mirrors, free-form mirrors, etc.

Product Specifications

Polishing Material Parameters	
SPDT (single point diamond turning)	Capable of processing various types of spherical, freeform, array, aspheric, and diffractive surfaces, Fresnel, various off-axis mirrors, and reflective mirrors.
Size	3~700(mm)
Pt	<1μm or special customization 0.1~0.5um
RMS/Ra	<0.1um or special customization 30～60nm/＜3nm
Centering	<1' or special customization 0.4'
Ring band error	≤1μm
Surface smoothness	60/40、40/20

Finished Product Display

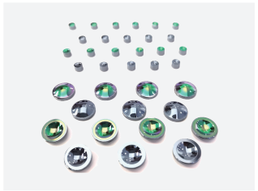


Precision Molding

Precision Molding Workshop Equipment Capacity Status				
Serial Number	Process	Equipment Model	Unit	Annual Equipment Capacity
1	Precision Molding Workshop	Multi-station Molding Equipment	Pcs	1.4 million
2		Single-station Molding Equipment	Pcs	0.8 million

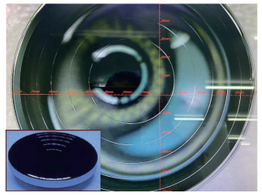
Chalcogenide glass molded lenses

Large-aperture molded aspheric lens + binary surface lens



Aspheric lenses

Customized lenses



Concave aspheric + binary surface lens

Molded Lens Specification Parameter Table				
Item	Outer Diameter Range			Customized Products for Customers
	Φ1.0~7.9mm	Φ8.0~20mm	Φ20.0~37mm	
PV	<0.5um	<1.5um	<3.0um	Providing Customized Optical Systems and Product Solutions
PV(After Optimization)	<0.2um	<0.8um	<1.0um	
RMS	<0.05um	<0.10um	<0.20um	
Center Deviation Control	<=45”	<=60”	<=120”	
Center Thickness Tolerance	±0.015mm			
Outer Diameter Tolerance	±0.015mm			
Surface Smoothness	40/20&60/40	60/40&80/50	80/50&100/60	
Glass Supply		VOT, Customer-Specified Glass		

Coating

Various types of infrared films

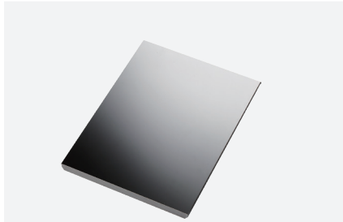
- AR coating to improve the infrared spectral transmittance of lenses and enhance optical imaging effects.
- HD coating to improve the lens's resistance to friction and extend service life.
- DLC coating to enhance the hardness and corrosion resistance of lenses.
- HR coating to improve the ultra-high reflectance of lenses.
- IR coating to achieve different spectral band pass-through effects.

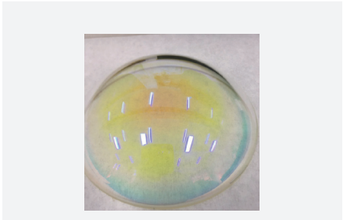
Various types of metal films

- Metal Reflective Film
- Metallized films for infrared windows
- Electrically Conductive Metal Ring

Features:

- Can coat a variety of materials with diamond-like carbon films, infrared anti-reflective coatings, and more.
- Coating bands cover 0.4~14um, such as: 8~12 micrometers or 3~5 micrometers enhancement films, diamond-like carbon films, multi-band enhancement films.
- The diameter of coated lenses ranges from 10 to 320mm(infrared film), and 10 to 400mm (diamond-like carbon film).
- Various types of filters can be coated.





Quality Inspection

- ISO9001、ISO14001、ISO45001 Certifications
- EU CE Product Certification (EMC, ROHS, RED)
- GB/T 29490-2013 Management System Certification
- US FCC (SDOC) Product Certification
- Pass the CNAS (China National Accreditation Service for Conformity Assessment) laboratory accreditation.

01

Quality System Establishment and Inspection Standards Development

- Infrared laser device inspection system.
- Development of material parameter detection methods.
- Standardization of lens inspection methods.
- Establishment of industry-related inspection standards.
- Establishment of corporate standards, etc.

02

Hardware Equipment

- MTF (Modulation Transfer Function) Analyzer
- MRTD (Maximum Reverse Tilt Diameter) Tester
- Taylor Surface Profile Mete
- Center Deviation Teste
- ZYGO Interferometer
- Coordinate Measuring Machine (CMM)
- Refractometer, etc.r

03 Inspection Items

- Detection of material properties such as resistivity, transmittance, refractive index, hardness, and grain size;
- Internal impurity detection of ZnSe and ZnS materials.
- Spherical surface deviation and aspheric optical surface deviatio of polished products;
- Coating product layer durability;
- Field curvature and optical distortion of optical elements;
- Application inspection of infrared laser devices such as optical lenses and complete machine performance.

04 Development Goals

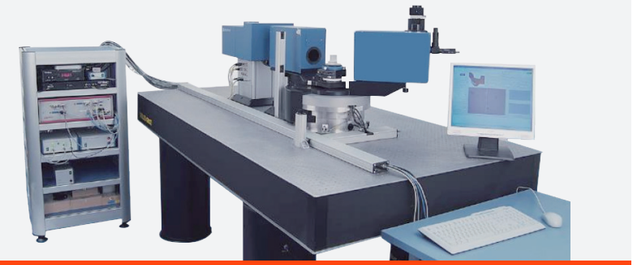
- Committed to becoming a first-class infrared detection center, capable of providing customized inspection services for customers.

Possessing an optical detection department capable of conducting systematic and professional inspections on optical lenses, lenses, and their components.

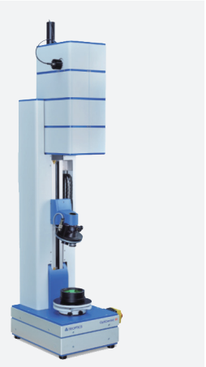
Material Detection	Optical Element Inspection	Optical Lens Inspection	Environmental Test Experiments
Resistivity, hardness, stress, absorption coefficient, transmittance, grain size, internal defects, refractive index,etc	Radius of curvature accuracy (N, △N), aspheric/spheric surface shape, center thickness, eccentricity, angle parallelism, surface smoothness, conductive ring inspection, etc.	MTF, focal length, field of view, aperture, field curvature, distortion, Relative illumination,etc.	High and low-temperature tests, high-temperature and high-humidity tests, thermal shock tests, salt spray tests, vibration tests, friction resistance tests, etc.

Testing Equipment and Applications

Equipment	Applications
MTF Measurement Instrument	Optical lens MTF, distortion, aperture, focal length and other parameter measurements
Ultra-Spherotronic Ultra-Precision Spherometer	Test lens curvature
PrismMaster® Precision Goniometer	Optical lens angle measurement
Opticentric® IR Infrared Centering Deviation Measuring Instrument	Optical lens center deviation measurement
ZYGO Interferometer	Optical lens spherical and flat surface measurement
LUPHOSCAN	Optical lens aspheric and diffraction surface profile test
Zeiss Coordinate Measuring Machine	Contact precision dimension measurement
UA3P	Precision measurement of curved surface, coaxiality, etc.
Fourier Transform Infrared Spectrometer	Infrared band transmittance measurement
UV-Visible-Near Infrared Spectrophotometer	UV-visible transmittance measurement
SpectroMaster® HR 600 UV-VIS-IR High-Precision Refractometer	Material refractive index measurement
Thermal Shock Chamber	Hot and cold shock test
Constant Temperature and Humidity Chamber Pt	Environmental simulation experiments such as high temperature and humidity, high and low temperature storage and environmental performance
Precision Salt Spray Test Chamber	Salt spray test
Vibration Test Table	Simulated transportation vibration test
Impact Test Table	Mechanical shock test
Wiper Test Chamber	Film wiper test

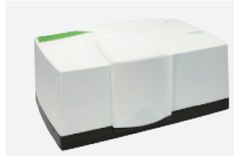

SpectroMaster® HR 600 UV-VIS-IR High-Precision Refractometer


ZYGO Interferometer


Opticentric® IR Infrared Centering Deviation Measuring Instrument


Zeiss Coordinate Measuring Machine


LUPHOSCAN


UV-Visible-Near Infrared Spectrophotometer


Fourier Transform Infrared Spectrometer

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