- POLARIZATION COMPONENTS
- OPTICAL COMPONENTS
- CRYSTAL COMPONENTS
- OPTICAL ASSEMBLIES
- OPTICAL COATING
- HOLDERS

FOCtek

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Optics/Filters/Polarizers/Waveplates/Crystals/Coating

Optical Assemblies/Lens Assemblies

福建福特科光电股份有限公司

FOCtek Photonics, Inc.

CATALOG 2015

Leading Manufacturer of Optical Components

About Us

Located in Fuzhou, a coastal city in South East China, FOCtek has become one of China's leading manufacturers of optical components, crystal components and optical assemblies, lens assemblies. Founded in 2002, FOCtek has had a strong and steady growth that has lead us to today's staff of over 1300 comprised of a very skilled team of fabricators, mechanical engineers, process engineers, optical engineers and coating designers.

Our manufacturing capabilities consist of all types of custom manufactured lens, Beam Splitters, Polarizing Optics, Prisms, Filters, Laser Crystals, NLO Crystals, Coatings, Optical Assemblies, Optical Systems, and Optical Systems Solutions. The products are widely used in non-contact inspection, medical, automation, precision instruments, Automotive, Military, Semiconductor, Micro-measuring systems, Biometric Systems, Surveying Equipment, Security, CCTV, and Machine Vision.

Sales have been global since the first year in operation. Europe, North America, Japan and Korea are most of the current customers base areas we supply. Dependable quality, delivery and competitive pricing has partnered FOCtek with many well establish World Famous Enterprises such as, TRUMPF, Magna Mirror, Thorlabs, ABB, EXFO Electro-Optical Engineering Inc., Nova Measuring Instruments Limited, Litron Laser, Renishaw and so on.

FOCtek owns facility of 17,500 square meters in Fuzhou which is included a 2,000 square meters clean room for our coating center, metrology lab, lens assembly and special fabrication needs. Since 2012, FOCtek has invested 50 million USD to establish a wholly owned subsidiary which owns factory building area of 100K square meters designed to meet our present and future needs in Sanming. The Phase I has been finished in May 2014, and now can reach capacity of 5 million lens components and 800K pieces lens assemblies per month.

FOCtek always pay highest attention on product quality and production capacity. Our advanced fabricating equipments include Spherical Milling Machines, CNC Plano Milling Machines, Precision Polishing Machines, High Speed Polishing Machine, CNC Profiling Machines, LEYBOLD Vacuum Coaters, Optorun Coaters and Ultrasonic Cleaning Lines.

Quality is first for FOCtek and always the key to our success. Foctek has the most advanced metrology instruments, include ZYGO GPI Interferometers, 3D digital CMM, Trioptics OptoSpheric Lens measurement system, Trioptics Prism Master 0.5" Angle measurer, Lambda 950 Spectrophotometer, Trioptics Image Master MTF Measurer. With these advanced metrology instrument and impeccable quality assurance system, FOCtek was ISO9001, ISO14001 and ISO/TS:16949 certified with SGS.

As a company, Foctek is committed to growth and development. Our cooperative relationship with Local Universities and research centers, such as Fujian Normal University, Fuzhou University and Fujian Optical technology research Institute, enhances our Engineering and R&D techniques.

Continue >>>

The co-established Joint Laboratory of optical technology between FOCtek and Fujian Normal University supports FOCtek with new project and development. Foctek was awarded the “Hi-tech Manufacturer” by the Fujian province. FOCtek also owns several patents in Polarization Optics, Optical technologies and Optical system.

With the concept of “Strict Management, Continuous Innovation, Continuous Improvement, Customer Satisfaction”, FOCtek is committed to deliver customers with Quality Products, On-time Delivery, Competitive Pricing. Foctek focuses on producing high precision optical components; The goal at FOCtek is to be your first choice of partner supplier of optical components.

Quality Products

Competitive Price

On-time Delivery

Value the Optics to Customers

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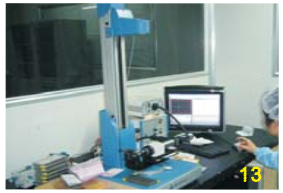
1.切割 Cutting
2.平面铣磨 Plano Milling
3.晶体手抛 Crystal Hand Polishing
4.环抛 Lapping Machine Polishing
5.光学抛光 Optics Polishing
6. 精密光学抛光 Precision Optics Polishing
7.数控光学加工 CNC Grinding and Profiling
8. 镀前擦拭 Cleaning
9. 超声波清洗 Ultrasonic Cleaner
10. 镀膜 Coating

出货 Shipment
包装 Packing
装配 Assembling
检验 Inspection
清洗 Cleaning
镀膜 Coating
研磨 Grinding
抛光 Polishing
切料 Cutting
成形 Forming
进料 Material



11. Zygo干涉仪 Zygo GPI XP/D4 Interferometer
12. 0.5"测角仪 Trioptics 0.5" PrismMaster
13. 透镜测量系统 Trioptics Lens Measurement
14. 3D 测量仪 3D Digital CMM
15. 传函测量系统 Trioptics ImageMaster MTF Measurer
16. Lambda 950分光光度计 Spectrophotometer
17. 数字测厚仪 Precision Thickness Measuring
18. 像质检测 Image Testing

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PART 1 OPTICAL COMPONENTS

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PART 1

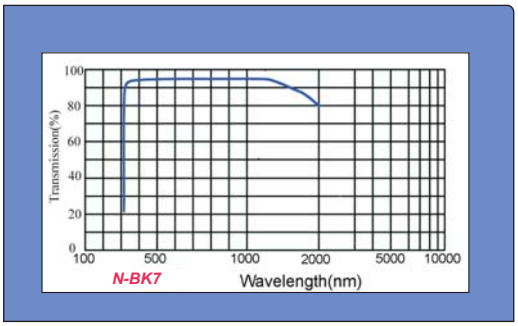
OPTICAL COMPONENTS

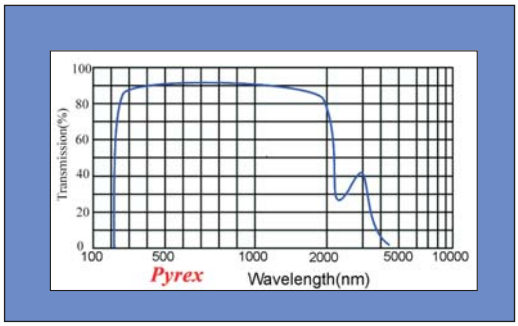
FOCtek has capability in manufacturing various optical components with a wide variety of optical materials. Selecting an optical material is important since each material has different optical characteristics, such as transmission versus wavelength, index of refraction, thermal, mechanical, chemical characteristics and so on.

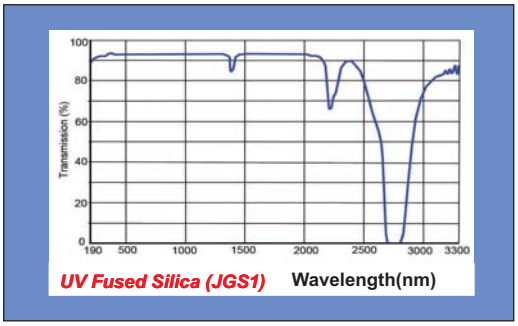
Many glass manufacturers offer the same material characteristics under different trade names. Based on availability, we reserve the right to substitute an equivalent glass in our production runs.

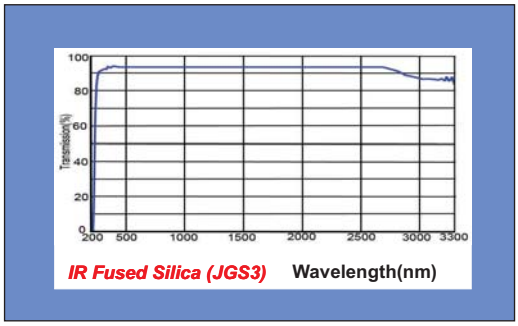
Herewith, the most common materials FOCtek used:

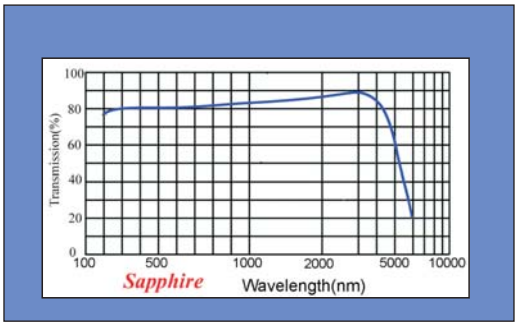
Materials	Refractive Index (nd)	Abbe Number (Vd)	Density (g/cm^3)	Transmission Range (μm)	Thermal Expansion Coefficient ($10^{-6}/K$)
N-BK7	1.5168	64.2	2.52	0.33 - 2.10	7.5
N-SF5	1.6726	32.17	4.08	0.33 - 2.50	8.2
N-SF11	1.78472	25.76	4.87	0.37 - 2.50	6.8
Fused Silica	1.45847	67.82	2.2	0.185 - 2.50	0.54
Pyrex	1.474009	65.38	2.23	0.23 - 2.70	3.25
CaF2	1.433849	94.99	3.18	0.17 - 7.80	18.85
Sapphire	1.768234	72.24	3.99	0.18 - 4.50	5.8
Silicon	3.47		2.33	1.5 - 8.0	2.6
Borofloat	1.47140	65.41	2.23	0.33 - 2.60	3.25

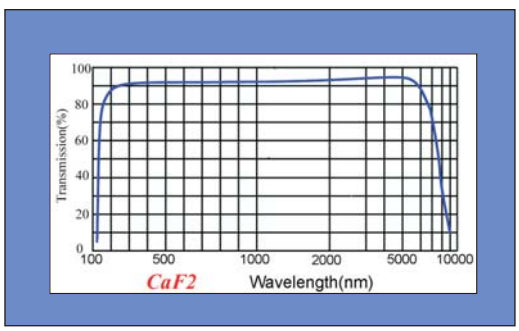








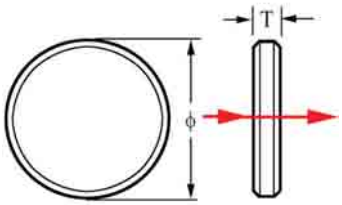


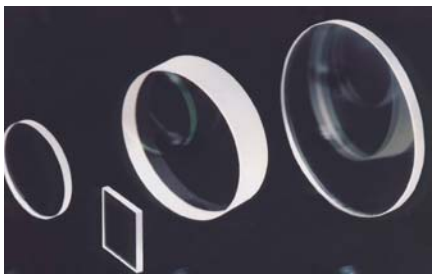


Window

Besides standard windows, Foctek offers all kinds of custom-made windows according to customers' requirement:

- Windows made from materials such as N-BK7, Fused Silica, Sapphire, CaF_2, Silicon, Borofloat, Pyrex, or other optical glass supplied by Schott and Chinese CDGM are available upon request.
- Windows at any size is available upon request.
- Windows at shape of round, quadrate, triangular or other polygonal are available upon request.
- Windows with single-layer or multip-layer AR, HR, PR coatings are available upon request.





N-BK7 Window

Attribute	Specification
Typical Diameter (Φmm)(1)	10.0, 12.7, 15.0, 20.0, 25.4, 30.0, 38.1, 50.8
Typical Thickness (mm)(2)	2.0, 3.0, 6.0, 6.35
Diameter Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.02 (High Precision)
Thickness Tolerance (mm)	±0.2 (General), ±0.005 (High Precision)
Clear Aperture(3)	>80% (Small Size), >95% (Large Size)
Parallelism	3 min. (General), 3 sec. (High Precision)
Surface Quality	60/40 (General), 10/5 (High Precision)
Flatness (per 25mm@633nm)	λ /2(General), λ/10 (High Precision)
Bevel (face width x 45°) (4)	<0.25mm
Coating(5)	Uncoated, AR, HR, PR, Coating, etc.

Note for N-BK7 Window:

(1). Custom-made N-BK7 windows at any size from Φ2.0mm to Φ350mm clear aperture are available. Besides round, N-BK7 windows at shape of quadrate, triangular, or other polygonal are available.

(2). Thickness from 1.0mm to 50.0 mm is available upon request.

(3). 100% clear aperture is available upon request.

(4). Better bevel is available upon request.

(5). N-BK7 Windows with Anti-Reflective(AR), High-Reflective(HR), Partial-Reflective(PR) coating are available.

Fused Silica Window

Attribute	Specification
Typical Diameter (Φmm)(1)	10.0, 12.7, 15.0, 20.0, 25.4, 30.0, 38.1, 50.8
Typical Thickness (mm)(2)	2.0, 3.0, 6.0, 6.35
Diameter Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.02 (High Precision)
Thickness Tolerance (mm)	±0.2 (General), ±0.005 (High Precision)
Clear Aperture(3)	>80% (Small Size), >95% (Large Size)
Parallelism	3 min. (General), 3 sec. (High Precision)
Surface Quality	60/40 (General), 10/5 (High Precision)
Flatness (per 25mm@633nm)	λ /2(General), λ/10 (High Precision)
Bevel (face width x 45°) (4)	<0.25mm
Coating(5)	Uncoated, AR, HR, PR, Coating, etc.

Note for Fused Silica Window:

(1). Custom-made Fused Silica windows at any size from Φ2.0mm to Φ350mm clear aperture are available. Besides round, Fused Silica windows at shape of quadrate, triangular, or other polygonal are available

(2). Thickness from 1.0 mm to 50.0 mm is available upon request.

(3). 100% clear aperture is available upon request.

(4). Better bevel is available upon request.

(5). Windows with Anti-Reflective(AR), High-Reflective(HR), Partial-Reflective(PR) coating are available.

Sapphire Window

Attribute	Specification
Typical Diameter (Φmm)(1)	8.0, 10.0, 12.7, 15.0, 20.0, 25.4, 30.0
Typical Thickness (mm)(2)	0.5, 1.0, 2.0
Diameter Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.1 (High Precision)
Thickness Tolerance (mm)	±0.2 (General), ±0.05 (High Precision)
Clear Aperture	>75% (Small Size), >90% (Large Size)
Parallelism	3 min. (General), 10 sec. (High Precision)
Surface Quality	80/50 (General), 40/20 (High Precision)
Flatness (per 25mm@633nm)	λ(General), λ/4 (High Precision)
Bevel (face width x 45°)(3)	<0.25mm
Coating(4)	Uncoated, AR, HR, PR, Coating, etc.

Note for Sapphire Window:

(1). Custom-made Sapphire windows at any size are available. Besides round, Sapphire windows at shape of quadrate, triangular, or other polygonal are available

(2). Other thickness from 0.5mm to 50.0 mm is available upon request.

(3). Better bevel is available upon request.

(4). Windows with Anti-Reflective(AR), High-Reflective(HR), Partial-Reflective(PR) coating are available.

CaF_2 Window

Attribute	Specification
Typical Diameter (Φmm)(1)	8.0, 10.0, 12.7, 15.0, 20.0, 25.4, 30.0
Typical Thickness (mm)(2)	1.0, 2.0, 3.0, 4.0
Diameter Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.1 (High Precision)
Thickness Tolerance (mm)	±0.2 (General), ±0.05 (High Precision)
Clear Aperture	>80% (Small Size), >90% (Large Size)
Parallelism	3 min. (General), 10 sec. (High Precision)
Surface Quality	80/50 (General), 40/20 (High Precision)
Flatness (per 25mm@633nm)	λ(General), λ/4 (High Precision)
Bevel (face width x 45°)(3)	<0.25mm
Coating(4)	Uncoated, AR, HR, PR, Coating, etc.

Note for CaF_2 Window:

(1). Custom-made CaF_2 windows at any size are available.
Besides round, CaF_2 windows at shape of quadrate, triangular, or other polygonal are available.

(2). Typical thickness is 2mm, 3mm, 4mm, other thickness from 1.0mm to 20.0 mm is available.

(3). Better bevel is available upon request.

(4). CaF_2 Windows with Anti-Reflective(AR), High-Reflective(HR), Partial-Reflective(PR) coating are available.

Silicon Window

Attribute	Specification
Typical Diameter (Φmm)(1)	8.0, 10.0, 12.7, 15.0, 20.0, 25.4, 30.0
Typical Thickness (mm)(2)	1.0 ～ 20.0
Diameter Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.1 (High Precision)
Thickness Tolerance (mm)	±0.2 (General), ±0.05 (High Precision)
Clear Aperture	>80% (Small Size), >90% (Large Size)
Parallelism	3 min. (General), 10 sec. (High Precision)
Surface Quality	60/40 (General), 10/5 (High Precision)
Flatness (per 25mm@633nm)	λ (General), λ /4 (High Precision)
Bevel (face width x 45°)(3)	<0.25mm
Coating(4)	Uncoated, AR, HR, PR, Coating, etc.

Note for Silicon Window:

(1). Custom-made Silicon windows at any size are available.
Besides round, shape of quadrate, triangular, or other polygonal are available.

(2). Thickness from 1.0mm to 20.0 mm is available upon request.

(3). Better bevel is available upon request.

(4). Si Windows with Anti-Reflective(AR), High-Reflective(HR), Partial-Reflective(PR) coating are available.

Borofloat Window

Attribute	Specification
Typical Diameter (Φmm) (1)	8.0, 10.0, 12.7, 15.0, 20.0, 25.4, 30.0
Typical Thickness (mm) (2)	1.0 ～ 50.0
Diameter Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.02 (High Precision)
Thickness Tolerance (mm)	±0.2 (General), ±0.005 (High Precision)
Clear Aperture	>80% (Small Size), >95% (Large Size)
Parallelism	3 min. (General), 3 sec. (High Precision)
Surface Quality	60/40 (General), 10/5 (High Precision)
Flatness (per 25mm@633nm)	λ /2(General), λ/10 (High Precision)
Bevel (face width x 45°) (3)	<0.25mm
Coating (4)	Uncoated, AR, HR, PR, Coating, etc.

Note for Borofloat Window:

(1). Custom-made Borofloat windows at any size are available.
Besides round, Borofloat windows at shape of quadrate, triangular, or other polygonal are available

(2). Thickness from 1.0mm to 50.0 mm is available upon request.

(3). Better bevel is available upon request.

(4). Windows with Anti-Reflective(AR), High-Reflective(HR), Partial-Reflective(PR) coating are available.

Borosilicate (Pyrex) Window

Attribute	Specification
Typical Diameter (Φmm) (1)	8.0, 10.0, 12.7, 15.0, 20.0, 25.4, 30.0
Typical Thickness (mm) (2)	1.0 ～ 50.0
Diameter Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.02 (High Precision)
Thickness Tolerance (mm)	±0.2 (General), ±0.005 (High Precision)
Clear Aperture	>80% (Small Size), >95% (Large Size)
Parallelism	3 min. (General), 3 sec. (High Precision)
Surface Quality	60/40 (General), 10/5 (High Precision)
Flatness (per 25mm@633nm)	λ /2(General), λ/10 (High Precision)
Bevel (face width x 45°) (3)	<0.25mm
Coating (4)	Uncoated, AR, HR, PR, Coating, etc.

Note for Borosilicate Window:

(1). Custom-made Borosilicate windows at any size are available.
Besides round, Borosilicate windows at shape of quadrate, triangular, or other polygonal are available

(2). Thickness from 1.0mm to 50.0 mm is available upon request.

(3). Better bevel is available upon request.

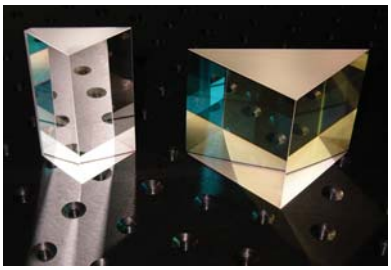
(4). Windows with Anti-Reflective(AR), High-Reflective(HR), Partial-Reflective(PR) coating are available.

Prism

FOCtek provides many kinds of high precision prisms, including Penta Prism, Beamsplitter Penta Prism, Right Angle Prism, Corner Cube, Dove Prism, Other prisms such as Reflection Prism, Dispersion, Beamsplitter and so on.

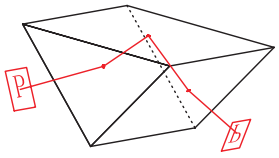
Right Angle Prism

Right angle prism is also called half cube prism or isosceles.

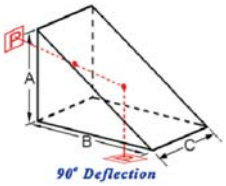


Besides standard Right Angle Prisms made of N-BK7 or Fused Silica, Foctek also offers custom-made Right Angle Prisms:

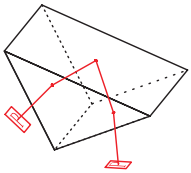
- Materials such as H-ZF1, H-ZF13, N-SF11, Pyrex, Sapphire and other optical glass and crystals are available.
- Size from 1.0x1.0x1.0mm to 300.0x300.0x300.0mm are available.
- Angle tolerance such as 3 min., 1min., 30sec., 10sec., 5sec. is available.
- AR, HR, PR coating are available.



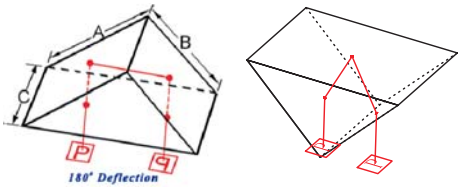
45°



90°



135°



180°

N-BK7 Right Angle Prism

Attribute	Specification
Material	N-BK7 Grade A optical glass
Dimension (mm) (1)	1.0x1.0x1.0 ～ 300.0x300.0x300.0
Dimension Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.05 (High Precision)
Clear Aperture	>80% (Small Size), >95% (Large Size)
Angle Tolerance (degree) (2)	<3 min. (General), <3 sec. (High Precision)
Flatness @633nm	λ/2 (General), λ/4 (High Precision)
Surface Quality	60/40 (General), 10/5 (High Precision)
Bevel (mm) (3)	0.1 ～ 0.5
Coating (4)	uncoated, AR, PR, HR Coating, etc.

Note for N-BK7 Right Angle Prism:

(1). Typical dimension is 2.0mm, 3.2mm, 5.0mm, 10.0mm, 12.7mm, 15.0mm, 20.0mm, 25.4mm, 30.0mm, dimension from 1.0x1.0x1.0 mm to 300x300x300 mm is available.

(2). Better precision such as 1 min., 30sec., 15sec., 10sec., and 5sec. is available.

(3). Typical bevel is 0.25x45^0, other bevel from 0.1x45^0 to 0.5x45^0 is available upon request.

(4). Anti-Reflective(AR), High-Reflective(HR), Partial-Reflective(PR) coating is available.

Fused Silica Right Angle Prism

Attribute	Specification
Material (1)	UV Fused Silica
Dimension (mm) (2)	1.0x1.0x1.0 ～ 300.0x300.0x300.0
Dimension Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.05 (High Precision)
Clear Aperture	>80% (Small Size), >95% (Large Size)
Angle Tolerance (degree) (3)	<3 min. (General), <3 sec. (High Precision)
Flatness @633nm	λ/2 (General), λ/4 (High Precision)
Surface Quality	60/40 (General), 10/5 (High Precision)
Bevel (mm) (4)	0.1 ～ 0.5
Coating (5)	uncoated, AR, PR, HR Coating, etc.

Note for Fused Silica Right Angle Prism:

(1). Besides Fused Silica, custom-made Right Angle Prisms, which are made of other optical materials, such as N-BK7, N-SF11, Pyrex, etc. are available.

(2). Typical dimension is 5.0mm, 10.0mm, 12.7mm, 15.0mm, 20.0mm, 25.4mm, 30.0mm, dimension from 1.0x1.0x1.0 mm to 300.0x300.0x300.0 mm is available.

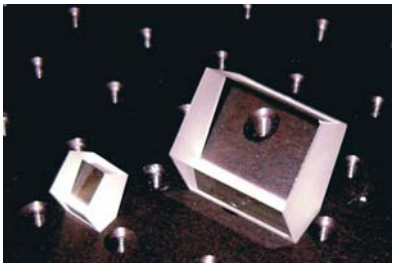
(3). Better precision such as 1 min., 30sec., 15sec., 10sec., and 5sec. is available.

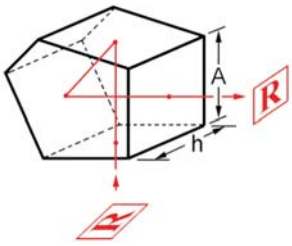
(4). Typical bevel is 0.25mmx45^0, other bevel from 0.1mmx45^0 to 0.5mmx45^0 is available upon request.

(5). Anti-Reflective(AR), High-Reflective(HR), Partial-Reflective(PR) coating prisms are available.

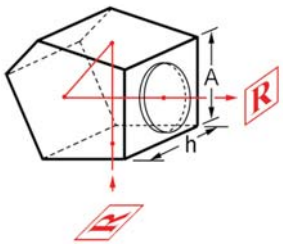
Penta Prism

Penta prism can deviate an incident beam without inverting or reversing to 90°. The deviation angle of 90° is independent of any rotation of the prism about an axis parallel to the line of intersection of the two reflecting faces. It is commonly used in Plumb Level, Surveying, Alignment, Range finding and Optical Tooling. The reflecting surfaces of this Prism must be coated with a metallic or dielectric coating. The standard Penta Prism reflecting surfaces are coated with aluminum or enhanced aluminum.





Typical Penta Prism



High Precision Penta Prism

Attribute	Specification
Material (1)	N-BK7 Grade A optical glass
Dimension Axh (mm) (2)	2.5x2.5 ~ 100.0x100.0
Dimension Tolerance (mm)	±0.2 (General), ±0.05 (High Precision)
90^0 Deviation Tolerance (3)	<1 min. (General), <3 sec. (High Precision)
Flatness @633nm	λ/2 (General), λ/4 (High Precision)
Reflection (per face@400-700nm)(4)	R>90%
Surface Quality	60/40 (General), 20/10 (High Precision)
Coating on input and output sides(5)	uncoated, AR Coating, etc.

Note for Penta Prism:

(1). Besides N-BK7 glass, other optical glass is available for custom-made Penta Prisms.

(2). Penta Prism at bigger size is available.

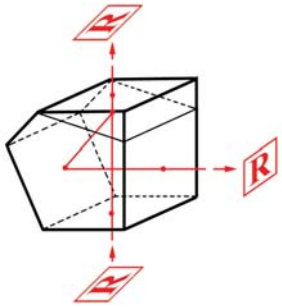
(3). Typical deviation tolerance is 1 minute, better precision such as 30 sec, 10 sec, 5 sec or 3 sec is available.

(4). Typical reflection is >90% by Al coating, other metal coating such as Ag, Cu, or High Reflection Dielectric Coating is available.

(5). Besides uncoating, Anti-Reflective(AR) coating is available upon request.

Beamsplitter Penta Prism

By adding a wedge and with partial reflective coating on first reflective surface, Penta Prism can be used as a Beamsplitter. We supply Beamsplitter Penta Prism with standard transmission/reflection (T/R) ratio of 20/80, 50/50. Other T/R ratio is available upon request.



Beamsplitter Penta Prism

Attribute	Specification
Material (1)	N-BK7 Grade A optical glass
Dimension Axh (mm^2) (2)	2.5x2.5 ~ 100.0x100.0
Dimension Tolerance (mm)	±0.2 (General), ±0.05 (High Precision)
90^0 Deviation Tolerance (3)	<1 min. (General), <3 sec. (High Precision)
Flatness @633nm	λ/2 (General), λ/4 (High Precision)
Reflection (per face@400-700nm) (4)	R>90%
Surface Quality	60/40 (General), 20/10 (High Precision)
Beamsplitter Ratio Transmission/Reflection (5)	20/80 ± 5 or 50/50 ± 5
Coating on input and output sides (6)	uncoated, AR Coating, etc.

Note for Beamsplitter Penta Prism:

(1). Besides N-BK7 glass, other optical glass is available for custom-made Penta Prisms.

(2). Typical dimension Axh is from 2.5x2.5-100.0x100.0 mm.

(3). Typical deviation tolerance is 1 minute, better precision such as 30 seconds, 10 seconds, 5 seconds, 3 seconds is available.

(4). Typical reflection is >90% by Al coating, other metal coating such as Ag, Cu, or High Reflection Dielectric Coating is available.

(5). Typical Beamsplitter Ratio Transmission/Reflection is 20/80±5 or 50/50±5, other Ratio is available.

(6). Besides uncoating, Anti-Reflective(AR) coating is available upon request.

Corner Cube Retroreflector

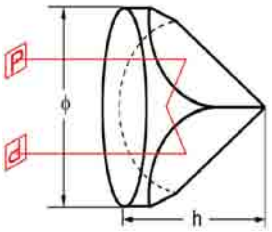
Corner Cube Prism is also called Retroreflector or Trihedral Prism. In the Corner Cube Prism, three reflecting surfaces are perpendicular to each other, like the side wall of the cube. The input surface is perpendicular to the cube diagonal. Disregarding the angle of incidence, the output beam is parallel to the input one, but it is of opposite direction. Inset of the several corner prisms, for better matching, their entrance-exit surface is often hexagonal. In case of this prism the phenomenon of full internal reflection occurs so it is not necessary, (however it is possible) to put mirror coating on the reflecting faces. Normally the reflection surfaces are Al reflection coating, and then covered with Cu and Black Painting.

Standard Specifications

Attribute	Specification
Material (1)	N-BK7 Grade A optical glass
Dimension Tolerance (mm)	+0.0/-0.2
Clear Aperture	80%
Deviation (2)	180^0±3 arc senconds.
Flatness (@633nm)	λ/4 on big surface, λ/8 on reflection surfaces
Surface Quality (3)	60/40
Bevel (mm)	0.2-0.5
Reflection coating on reflection surfaces (4)	upon request
Coating on input and output sides (5)	upon request

Standard Series (6)

Part No.	Φ (mm)	h(mm)
FCC1101	15.0	11.3
FCC1102	25.4	19.0
FCC1103	38.0	28.5
FCC1104	50.8	37.5



Note for corner cube retroreflector:

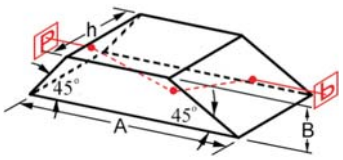
(1). Besides N-BK7, custom-made corner cube Prisms made of other optical materials are available.
(2). Corner Cube Prisms with lower deviation tolerance, such as 1', 30", or 10", are available.
(3). Corner Cube Prisms with better surface Quality (better than 40/20 or 20/10) are available.
(4). HR or Metal reflection coating(Al, Ag, Cu, etc.) on reflection surfaces is available.
(5). AR coating on input/output surface is available upon request.
(6).Custom-made non-standard Corner Cube Prisms at any other size are available upon request.

Dove Prism

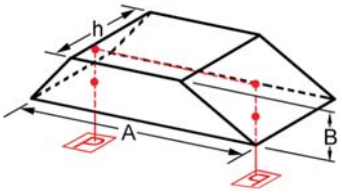
The Dove Prism is also called Image Rotator. The prism rotates the image without changing the direction of the input beam, which is parallel to hypotenuse. Rotation of the prisms in relation to the subject causes double rotations of the image. Dove Prism should be used in the parallel beam.

Standard Specifications

Attribute	Specification
Material (1)	N-BK7 Grade A optical glass
Dimension Tolerance (mm) (2)	+0.0/-0.2
Clear Aperture	>80% (Small Size), >95% (Large Size)
Deviation (3)	±3 arc min., etc.
Flatness (@633nm) (4)	λ/2
Surface Quality (5)	60/40
Bevel (mm)	0.2 ~ 0.5
Coating (6)	uncoated



90° Deflection



180° Deflection

Standard series (7)

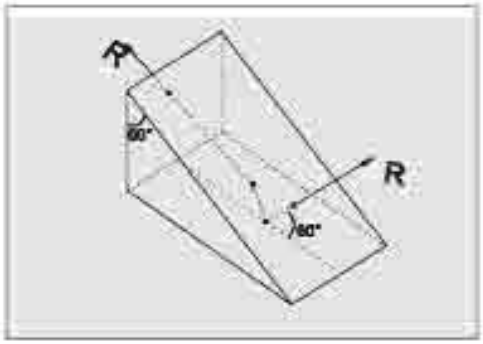
Part No.	A(mm)	B(mm)	h(mm)
FDP1101	21.1	5.0	5.0
FDP1102	42.3	10.0	10.0
FDP1103	63.4	15.0	15.0

Note for Dove Prism:

(1). Dove Prisms made of any other optical material are available upon reqest.
(2). High precision tolerance at better than +0.0/-0.05nm is available.
(3). Angle tolerance better than 10 arc sec. is available upon request.
(4). Flatness better than λ/4 is available.
(5). Surface quality better than 20/10 is available.
(6).Dielectric HR coating or Metal reflection coating on reflection surfaces is available.
AR coating on input/output surface is available.
(7). Custom-made non-standard Dove Prisms at any other size are available upon request.

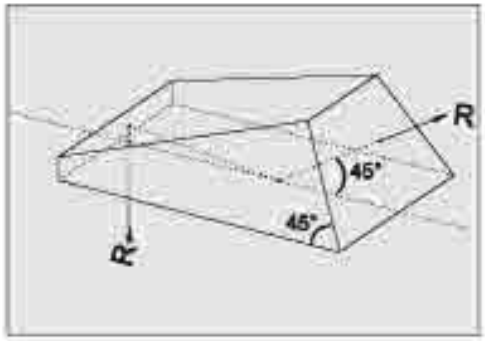
Reflection Prism

The reflection prisms are usually used for diverging the ray or for changing image location in relation to the subject (rotation, inversion). All the surfaces of the reflection prisms are flat. Reflection surfaces are mirrored, but it is possible, however to make use of Total Internal Reflection (TIR). Besides the Right angle prism, Penta prism, Corner Cube and Dove Prism, Foctek also produces many other kinds of Reflection Prism, for examples, the Bauernfeind Prism, Roof Prism, Rhomboid Prism, Abbe-Koenig Prism.



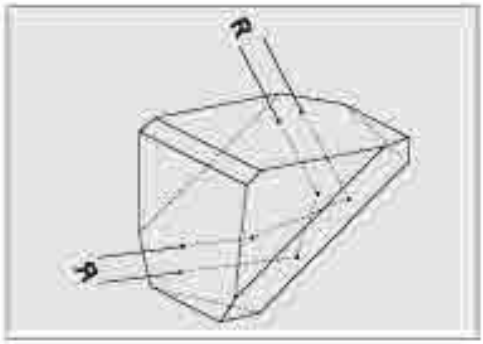
BAUERNFEIND prism 60°

The input beam is deflected by 60°, which depends on the 60° angle between the input surface and the first reflection surface. There is neither horizontal nor vertical displacement of the image. It is necessary to put the mirror coating on the longer short surface of the prism.



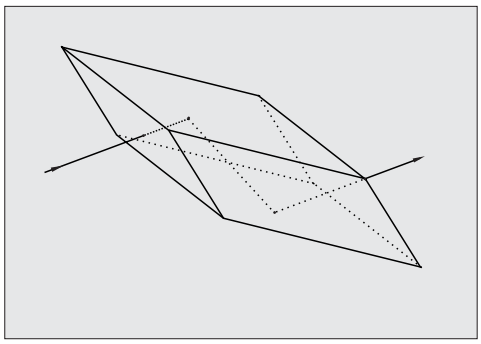
BAUERNFEIND prism 45°

The input beam is deflected by 45°. There is neither horizontal nor vertical displacement of the image. It is necessary to put the mirror coating on the longer short surface of the prism.



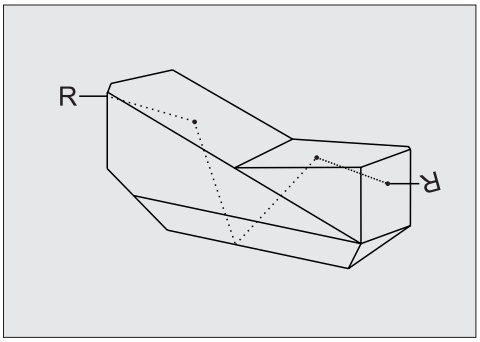
AMICI roof prism

AMICI reflection prism called also roof prism or right angle roof prism, which deflects the beam through an angle of 90° and inverts the image. For this reason, this prism is perfect for erecting images inverted by the objectives.



RHOMBOID prism (off-set prism)

The RHOMBOID prism simply displaces beam at a certain distance. It doesn't cause any deviation and influence on orientation of the image.



ABBE-KOENIG prism

ABBE-KOENIG prism is an image erector. It consists of one roof prism and one right angle prism with their hypotenuse surface cemented. The Prism completely reverses the image.

Standard Specifications:

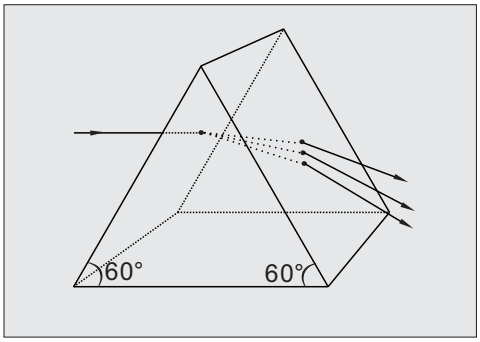
Attribute	Specification
Material	On request, for example N-BK7, Fused Silica, MgF_2, N-SF10, etc.
Range of Size (mm)	4 ～ 300
Dimension Tolerance (mm)	±0.1
Clear Aperture	>90%
Angle Accuracy	±3 arc min.
Pyramid Error	±5 arc min.
Flatness (@633nm)	<λ/2
Surface Quality	60/40
Coating	uncoated, AR, HR, PR coated etc.

Note:

According to Customer's requirement, we can make non-standard Reflection Prisms with significantly higher optical parameters. Surface quality better than 10/5, flatness better than λ/10, angle tolerance better than +/-10 arc sec is available. Prism in mounting is also available.

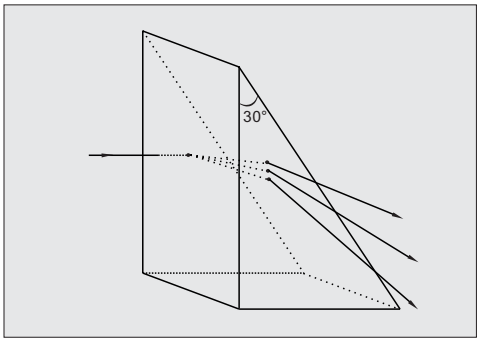
Dispersion Prism

Besides the Reflection Prisms, Foctek also offers the Dispersion Prisms. The most typical dispersion prism is equilateral prism made of high difference of refaction indexes for different wavelengths. The dispersion prisms of special use are: Litrow prisms, Pellin-Broca prisms, Brewster prisms, Amici Prisms.



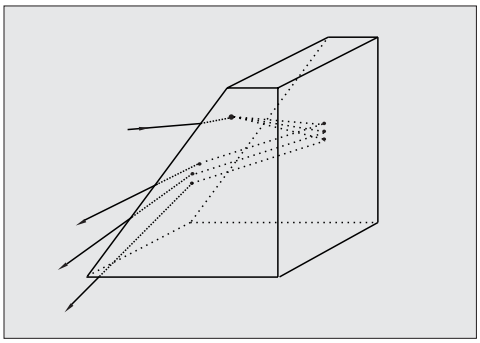
EQUILATERAL dispersion prism

EQUILATERAL dispersion prisms have three equal 60° angles, which are made of optical materials with high difference of refraction indexes for different wavelength, such as the SF_{10}.



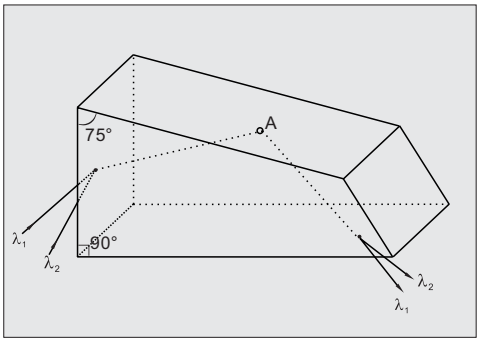
ISOSCELE prism

ISOSCELE dispersion prisms have the three angle with 30°- 60°- 90°. The prisms are also made of optical materials with high difference of refraction indexes for different wavelength, such as the SF_{10}.



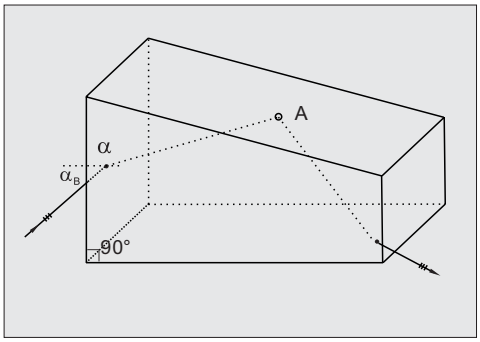
LITTROW prism

Light crossing the LITTROW prism is spectrally dispersed with simultaneous inversion of the path of rays caused by the reflection taking place on the back surface of the prism. The reflection surface has to be mirrored coating.



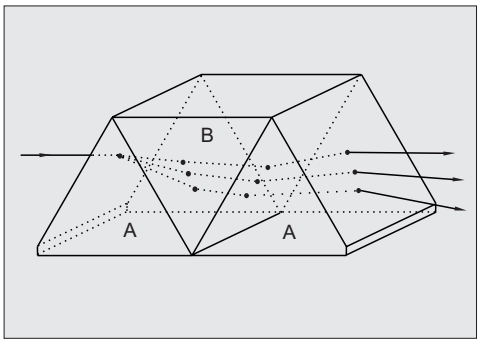
PELLIN - BROCA prism

PELLIN - BROCA prism is a special kind of dispersion prism. Besides dispersing properties, the prism has the property of diverging rays by 90°. By rotating the prism around it's A axis, you can select the wavelength what you require.



BREWSTER prism

BREWSTER prism is recommended for polarized light. P-polarized beam is transmitted with no losses when input beam is at the Brewster angle, while the S-polarized beam is reflected.



AMICI prism (Direct Vision Prisms)

The AMICI prisms generate dispersion of polychromatic light with simulaneous correction of divergence. All the dispersed beam output from the prism are parallel to the input beam. These Prisms consist of three prisms, which are cemented together. Two of the three prisms (A prism in the left draft) are made of different material to the other prism (B prism in the left draft). Typical combination of materials are Flint galss for A and Crown glass for B.

Standard Specifications:

Attribute	Specification
Material	On request, for example N-BK7, Fused Silica, MgF_2, $N\text{-}SF_{10}$ etc.
Range of Size (mm)	4 ～ 300
Dimension Tolerance (mm)	±0.1
Clear Aperture	>90%
Angle Accuracy	±3 arc min.
Pyramid Error	±5 arc min.
Flatness (@633nm)	<λ/2
Surface Quality	60/40
Coating	uncoated, AR, HR, PR coated etc.

Note:

According to Customer's requirement, we can make non-standard Dispersion Prisms with significantly higher optical parameters. Surface quality better than 10/5, flatness better than λ/10, angle tolerance better than +/-10 arc sec is available. Prism in mounting is also available.

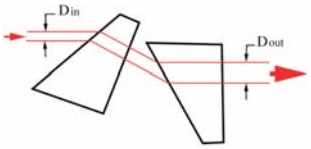
Anamorphic Prism

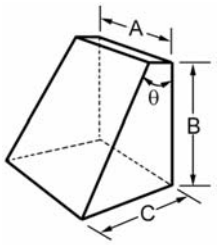
With a anamorphic prism, the beam size can be changed along the axis while leaving the beam unchanged along the other axis, so the beam can be expanded, reduced or reshaped.

Anamorphic prisms are used to correct the asymmetric, elliptical beams produced by laser diodes, so that the beams are nearly circular in shape.

Standard Specifications

Attribute	Specification
Material	N-SF11, H-ZF13 Grade A optical glass
Dimension Tolerance (mm)	+0.0/-0.2
Clear Aperture	80%
Flatness (@633nm)	λ/8
Theta	θ=29°27'± 30"
Surface Quality	60/40
Coating	MgF_2 single layer coating on perpendicular surface





Part No.	A(mm)	B(mm)	C(mm)
FAP0101	12.0	12.0	8.5

Mount of anamorphic prism is available upon request.

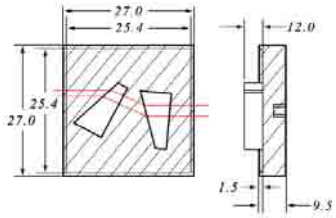
Note: The prism is counted quantity at every piece. It shall be used as pair (two pieces).

Holders for Anamorphic Prism

Specifications:

Material: Black anodized aluminum

Dimension tolerance: ± 0.1mm



Part No.	Width (mm)	Height (mm)	Thickness (mm)
APH12	27.0	27.0	9.5

Note: Please specify the anamorphic ratio for designing the holder.

RGB Prism (Philips Prism)

The RGB (Philips) Prism is designed for reflective LCOS Projector, matrix camera applications, and is well-suited to fast lenses imaging onto three CCD/CMOS sensors.

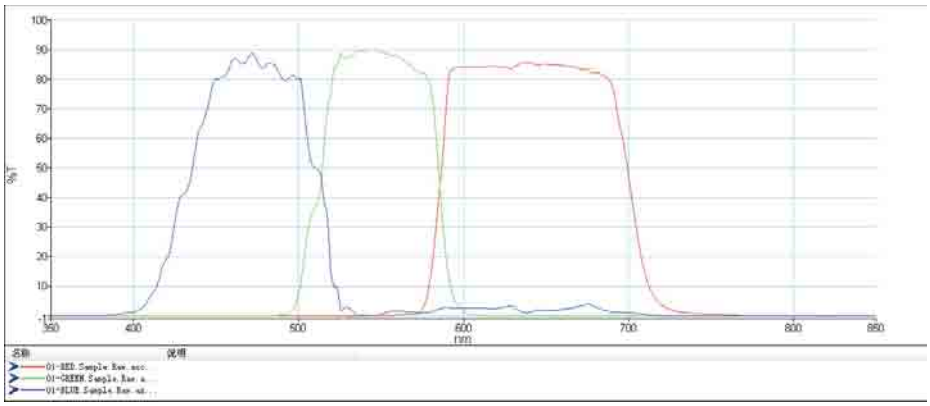
Foctek has developed the unique thin air-space (8um+/-2um) cementing technique for this prism, which allows Foctek to custom-made high precision Philips Prism for the customers.

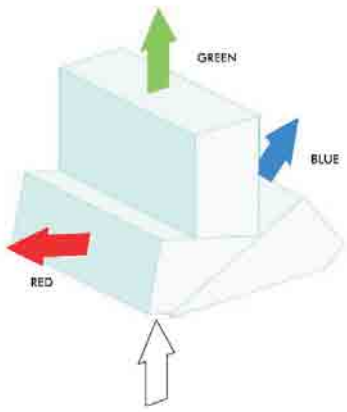
1.Coating for each prism:

Wavelength(nm)	430~480	520~560	600~670
B	HT, T>95%	T<0.1%	T<0.1%
R	T<0.1%	T<0.1%	HT, T>95%
G	T<0.1%	HT, T>95%	T<0.1%

2.Optical Parameters:

Attribute	Specification
Optical Path	14~150 mm
Clear Aperture	up to 50x50mm
Wavelength range	430~670nm
Antireflection coating	R<0.4%
Type of coating	Dichroic
Blue	430~480 nm
Green	520~560 nm
Red	600~670 nm
Transmission	>80%
Interface	upon request
Mount type	upon request
Output trimming filter	upon request



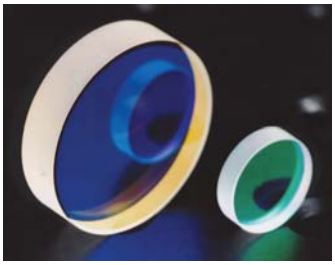


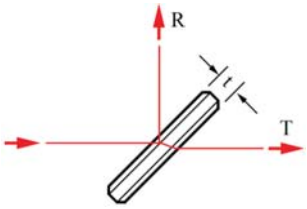
For three sensors camera application, Foctek also has the ability to assembly the sensors onto the prism output surfaces for you, and guarantee the high precision optical path and position between three sensors.

BeamSplitter

The common Beam splitters are used to split or combine laser beam. However Polarization BeamSplitters are used to split or combine two perpendicular polarization laser beam. The performance of beamsplitters is mainly dependent on the coating specifications.

BeamSplitter Plate





Material: ---------- N-BK7 or H-K9L Grade A optical glass
Dimension Tolerance: ---------- ±0.2mm
Thickness Tolerance: ---------- ±0.2mm
Flatness: ---------- λ/4@632.8nm
Surface Quality: ---------- 60-40 scratch and dig
Parallelism: ---------- <1 arc minute
T/R: ---------- 50/50±5%, for random polarization
---------- T=(Ts+Tp)/2, R=(Rs+Rp)/2
Coating: (Incidence Angle: 45 degree)
Surface 1: ---------- Partial Reflectance coating
Surface 2: ---------- AR Coating
Standard Coating wavelength:
Narrow Band: ----- 488, 532, 632.8, 650, 808, 850, 980, 1064, 1310, 1550 nm
Broadband: ---------- 450-650, 650-900, 900-1200, 1200-1550, 1500-1610 nm

Size(mm)	Narrow Band	Broadband
	Part No.	Part No.
10x10x2	BSP1103	BSP1203
12.7x12.7x2	BSP1104	BSP1204
25.4x25.4x2	BSP1105	BSP1205
ϕ25.4x2	BSP1106	BSP1206

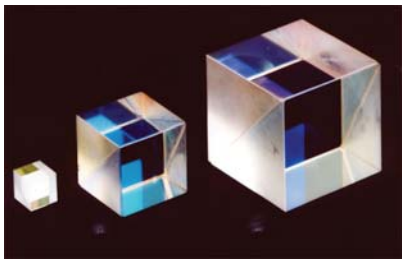
Ordering Information

Part No. - Wavelength
For Example, BSP1203 - 1500-1610nm
Beamsplitter 10x10mm, 1500-1610nm broadbacd coating

Note for BeamSplitter Plate:

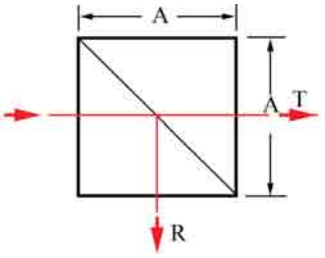
1.Custom-made non-standard Beamsplitter Plate at any size (from 2.0x2.0x2.0mm to 50.0x50.0x50.0mm) or shape (such as quadrate, triangular.) is available upon request.
2.Besides N-BK7, Custom-Made Beamsplitter Plate, which is made of other optical material, such as Fused Silica, Pyrex, is available upon request.
3. High Precision Beamsplitter Plate with better Flatness (<λ/8), Better Surface Quality (better than 20/10) and Better parallelism (<3") is available upon request.
4. Besides 50/50, non-standard splitting ratio (from T/R=90/10 to 10/90) is available upon request.

Cube BeamSplitter

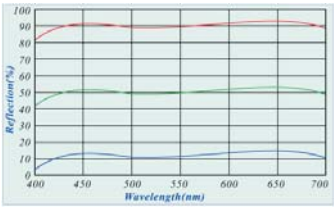


Cube beamsplitters are constructed by cementing two precision right angle prism together with appropriate interference coating on the hypotenuse surface. The absorption loss to the coating is minimal transmission and reflection approach 50% (average) though output is partially polarized. If polarization sensitivity is critical to your application, we recommended that you select from our Polarization Cube Beamsplitter or Non-polarization Cube Beamsplitter.

Material: ---------- N-BK7 or H-K9L Grade A optical glass
Dimension Tolerance: ---------- ±0.2mm
Flatness: ---------- λ/4@632.8nm
Surface Quality: ---------- 60-40 scratch and dig
Beam Deviation: ---------- <3 arc minutes
T/R: ---------- 50/50±5%, for random polarization
---------- T=(Ts+Tp)/2, R=(Rs+Rp)/2
Coating: Hypotenuse Face: ---------- Partial Reflectance coating
All Input and Output Faces: ---------- AR Coating
Standard Coating wavelength:
Narrow Band: ----- 488, 532, 632.8, 650, 808, 850, 980, 1064, 1310, 1550 nm
Broadband: ---------- 450-650, 650-900, 900-1200, 1200-1550, 1500-1610 nm



Size(mm)	Narrow Band	Broadband
	Part No.	Part No.
3.2x3.2x3.2	BSC1101	BSC1201
5x5x5	BSC1102	BSC1202
10x10x10	BSC1103	BSC1203
12.7x12.7x12.7	BSC1104	BSC1204
15x15x15	BSC1105	BSC1205
20x20x20	BSC1106	BSC1206
25.4x25.4x25.4	BSC1107	BSC1207



R=50%+/-5% @450-650nm

Ordering Information

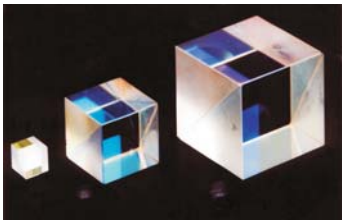
Part No. - Wavelength
For Example, BSC1203 - 1500-1610nm
Beamsplitter Cube 10x10x10mm, 1500-1610nm broadband coating

Note for Cube BeamSplitter:

1.Custom-made non-standard Beamsplitter Cube at any size (from 2.0x2.0x2.0mm to 50.0x50.0x50.0mm) is available upon request.
2.Besides N-BK7, Custom-Made Beamsplitter Cube, which is made of other optical material, such as Fused Silica, Pyrex, is available upon request.
3.High Precision Beamsplitter Cube with better Flatness (<λ/8), Better Surface Quality (better than 20/10) and Better Beam Deviation (<1') is available upon request.
4.Besides 50/50, non-standard splitting ratio (from T/R=90/10 to 10/90) is available upon request.

■Holder For Cube Beamsplitter is available, please see PART 6 HOLDER.

Non-Polarizing Cube BeamSplitter



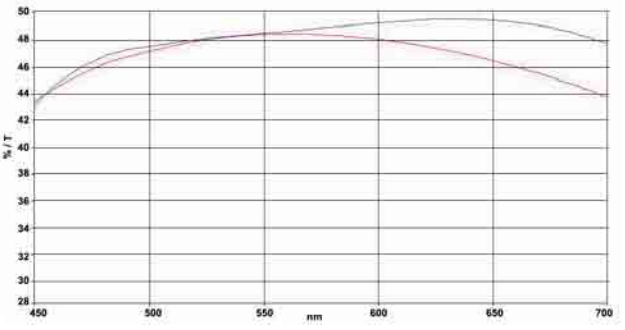
consists of a pair of precision high tolerance right angle prisms cemented together with a metallic-dielectric coating on the hypotenuse of one of the prisms. The low polarization dependence of the metallic-dielectric coating allows the transmission and reflection for S- and P- polarization states to be within 6% of each other. This means that they will not change the state of polarization of the incident beam.

We offer both broadband and single wavelength non-polarizing cube beamsplitters (NPBS). An antireflective coating has beem applied to each face of the beamsplitter in order to produce maximum transmission efficiency for the appropriate wavelength range.

Broadband NPBS Specification:

Material:---------- N-BK7 grade A, optical glass
Dimension Tolerance:---------- ±0.2mm
Flatness:----------λ/4 @ 632.8 nm per 25mm
Surface Quality:----------60/40 scratches and dig
Beam Deviation:----------<3 arc minutes
Clear Aperature:---------- 90%
Bevel:----------<0.3 mm X 45 deg
Coating: Hypotenuse Face: ----------NPBS Coating
All Input and Output Faces:----------AR Coating
Splitting Ratio: ---------- Tp/Rp=Ts/Rs=45%±5%
Polarization:---------- |Tp-Ts|<6%, |Rp-Rs|<6%
Absorption:----------<10%
AR Coating:---------- Ravg<0.5 @450-680nm, Ravg<0.5%@700-1000nm, Ravg<0.5%@1300-1600nm
Standard Wavelength: 450-680nm, 700-1000nm, 1300-1600nm.

Size(mm)	Part NO.
5.0x5.0x5.0	NPB1201
10.0x10.0x10.0	NPB1202
12.7x12.7x12.7	NPB1203
20.0x20.0x20.0	NPB1204
25.4x25.4x25.4	NPB1205
30.0x30.0x30.0	NPB1206
40.0x40.0x40.0	NPB1207
50.8x50.8x50.8	NPB1208

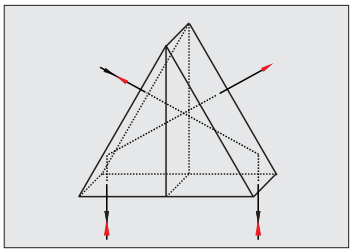


Tp=Ts=45%+/-5% @ 450nm-680nm

Note: Other sizes, split ratio and wavelengths are available upon request.

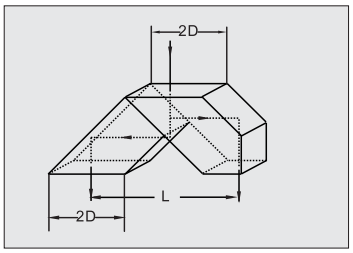
Ordering Information

Part No. - Wavelength
For Example, NPB1202 - 450~680nm
Non-polarizing Cube Beamsplitter 10x10x10mm, 450~680nm broadband coating



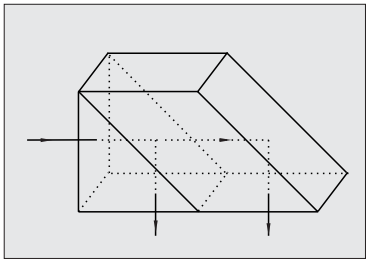
Koster Prism

The Koster Prism is made with two identical prisms (90º-60º-30º). Longer leg surfaces, with beam splitting coating on one of them, are cemented. With this prism, the light beam can be split into two parallel beams. The splitting ratio is depended on the coating. The Distance between two-output beams can be adjusted. The two-split beams have the same optical path.



Parallel Splitting Prism

This special Beam Splitter is made of two special designed prisms. The cemented surface of one prism is beam splitter coating. The Prism enables splitting beam of light per two beams parallel to each other, and parallel to the input beam with high accurate. The distance between two output beams can be different for different prism size, but, shall be at least 4 times of beam size. The two-split beams have the same optical path.



Beam-Splitting Prism

This special prism consists of one Right Angle prism and one Rhomboid Prism. The hypotenuse surface of the Right Angle Prism is beam-splitting coated and cemented to the Rhomboid Prism. The two split output beams are parallel to each other, and perpendicular to the input beam at high accurate. Distance of two-output beam can be different by changing the length of the rhomboid prism. The optical path of the two-split beams is different.

Standard Specifications:

Attribute	Specification
Material	On request, for example N-BK7, Fused Silica, MgF_2, N-SF_{10} etc.
Dimension Tolerance (mm)	±0.1
Clear Aperture	>90%
Angle Accuracy	±30 arc sec.
Beam Deviation Tolerance	±1 arc min.
Flatness (@633nm)	<λ/2
Surface Quality	60/40
Spectral Range (nm)	100-2500
Splitting Ratio R:T (%)	10:90 to 90:10
Coating	uncoated, dielectric coated AR, HR, PR or metal coated Al, Ag, Au etc.

Note:

According to Customer's requirement, we can make non-standard Beam Splitting Prisms with significantly higher optical parameters. Surface quality better than 10/5, flatness better than λ/10, angle tolerance better than +/-10 arc sec is available, beam deviation better than +/-15 arc sec is available. Prism in mounting is also available.

Lens

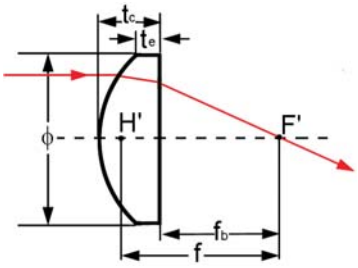
Optical lenses are transparent components made of one or more pieces of optical-quality materials (ground and polished or molded) and curved (always spherical) to converge or diverge transmitted rays from an object, These rays then form a real or virtual image of the object.

FOCtek provides spheric lens, aspheric lens, cylindrical lens and achromatic lens with a wide range of sizes and materials including N-BK7 , H-K9L, Fused Silica, N-SF5, Sapphire, CaF_2, Silicon, Germanium, etc.

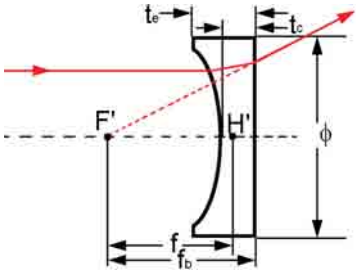
Spheric Lens

FOCtek provides five kinds of spheric lens forms, or shapes, that determine the imaging Characteristics of the lenses, they are plano-convex, plano-concave ,Double-convex, Double-concave and Meniscus.

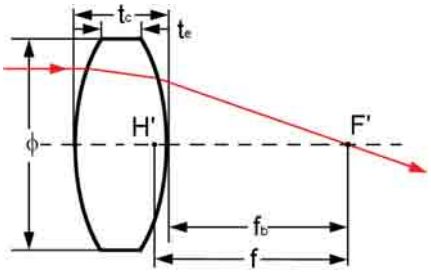
- Plano-convex lens has a positive focal length, which makes it ideal for collecting and focusing light for many imaging applications..
- Plano-concave lens has a negative focal length and is used for image reductinon or to spread light.
- Double-convex lens has a positive focal length and is useful for 1:1 imaging and in multielement systems. also known as biconvex or equiconvex.
- Double-concave lens has a negative focal length and is useful for 1:1 imaging and in multielement systems. also known as biconcave or equiconcave.
- Meniscus lense has a positive or negative focal length, it forms a real or virtual image of objects.



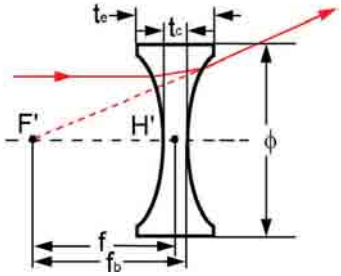
Plano Convex Lens



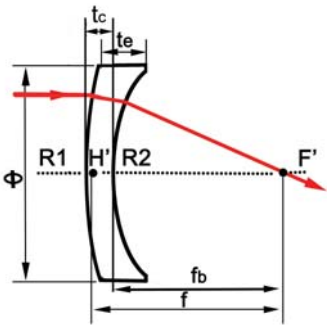
Plano Concave Lens



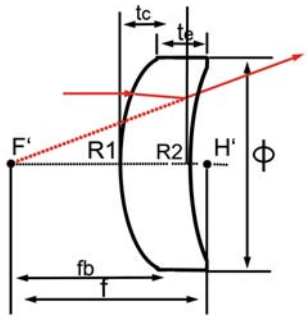
Double Convex Lens



Double Concave Lens



Positive Meniscus Lens



Negative Meniscus Lens

Specifications of Spheric Lens

Attribute	Specification
Material [1]	N-BK7, H-K9L,Fused Silica, N-SF10, Silicon, CaF_2, Sapphire etc.
Typical Diameter (Φmm)[2]	10.0, 12.7, 15.0, 20.0, 25.4, 30.0, 50.8, etc.
Diameter Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.02 (High Precision)
Paraxial Focal Length Tolerance (mm)[3]	±2%
Centration [4]	<3 arc min
Clear Aperture	>80% (Small Size), >95% (Large Size)
Surface Figure (per 25mm@632.8nm)	<1.5λ, (General), <λ/4 (High Precision)
IRR (@632.8nm)	<λ/4 (General), <λ/10 (High Precision)
Surface Quality	60/40 (General), 10/5 (High Precision)
Bevel (face width x 45^0)	<0.25mm
Coating [5]	uncoated, AR, HR, PR Coating, etc.

Note for Spheric Lens:

(1). Other optical glass materials from Schott or Chinese CDGM are also available upon request.

(2). Custom-made Spheric Lenses at any size from diameter 2.0mm to 300mm are available upon request.

(3). Typical paraxial focal length tolerance is ±2%, better tolerance is available upon request

(4). Typical centration is 3 arc minutes, better precision is available upon request.

(5). Besides uncoated, Lenses with Anti-Reflective(AR), High-Reflective(HR), Partial-Reflective(PR) coating are available upon request, Please refer to Part 5 OPTICAL COATING for more information about coating.





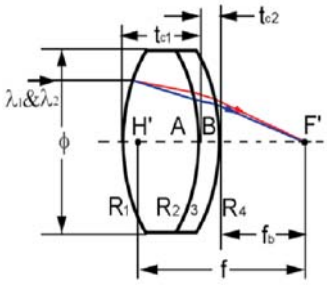

Mass Production: 1 Million Pieces Per Month

Medium/Small Batch Production: 100K Pieces Per Month

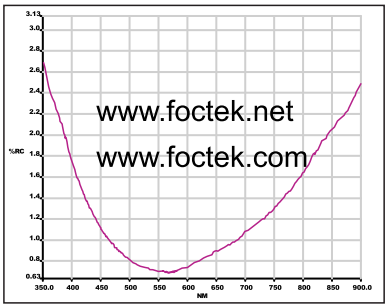
Achromatic Lens(1)

Achromatic lenses are very common type of viewer lenses, they consist of two or more lense elements,which have been corrected for chromatic aberration with respect to two selected wavelengths, The elements must be fixed in relation to one another by either mounting or cement.

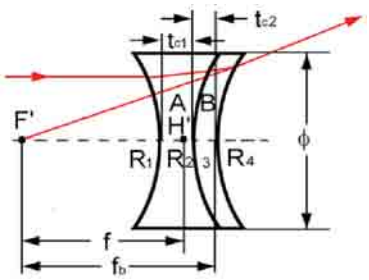
Achromatic Lenses are designed to specifically function within the infrared, visible, or ultra-violet wavelength ranges, and they are not symmetric devices. They must be installed with the correct front-to-back orientation (thicker element usually faces the eyes). If installed incorrectly, with the lens orientation installed backwards the result will be extensive distortion and aberration.



Positive Achromatic Lens



MgF_2@400 -700 Ravg<1.75%



Negative Achromatic Lens

AR/AR@750 -1605nm, R<1%

Attribute	Specification
Design Wavelength	unpon request
Diameter Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.02 (High Precision)
Paraxial Focal Length Tolerance (mm)	±2%
Centration	<3 arc min
Clear Aperture	>80% (Small Size), >95% (Large Size)
Surface Figure (per 25mm@632.8nm)	<1.5λ, (General), <λ/4 (High Precision)
IRR (@632.8nm)	<λ/4 (General), <λ/10 (High Precision)
Surface Quality	60/40 (General), 10/5 (High Precision)
Bevel (face width x 45^0)	<0.25mm
Coating	unpon request

Note:

(1). Please refer to our web for list of standard Achromatic Lenses.

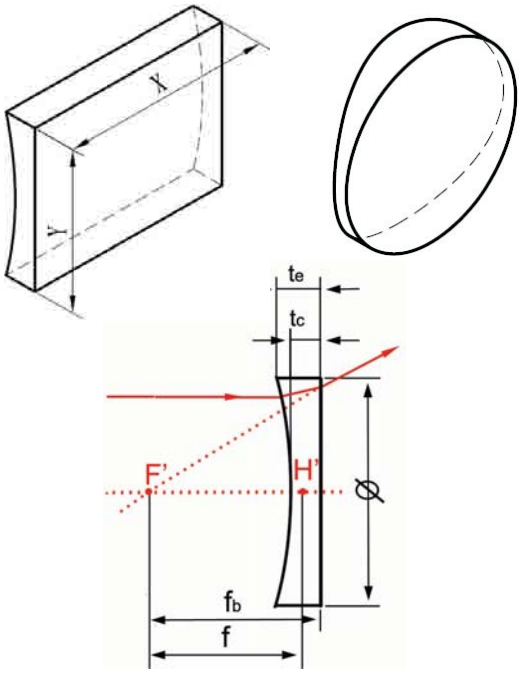
(2). Custom-made Achromatic Lenses are available from FOCtek.

(3). FOCtek can design Achromatic Lenses for you according your requirement.

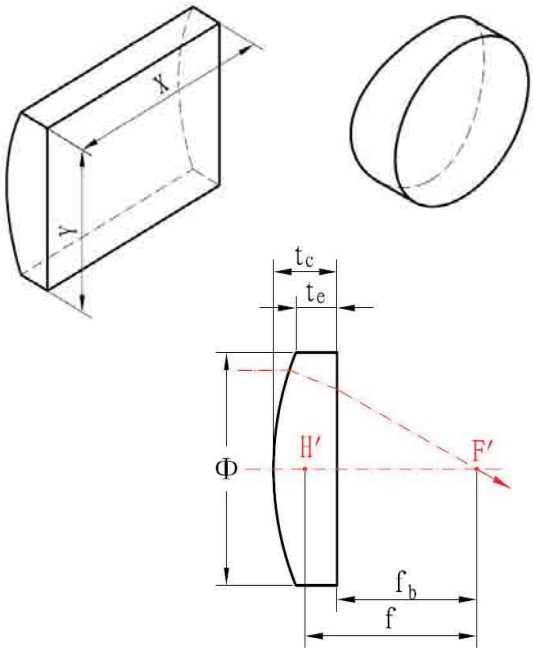
Cylindrical Lens

Cylindrical lenses are used to correct astigmatism in the eye and in rangefinders, to produce astigmatism, tretching a point of light into a line, they are widely used in bar code scanning, projection optics systems, laser measurement systems and holography.

Cylindrical lenses are available in either plano-concave or plano-convex configurations from FOCtek, Plano-concave lenses have a negative focal length and are used for image reduction or to spread light Plano-convex lenses have a positive focal length, which makes them ideal for collecting and focusing light for many imaging applications.



Plano-Concave Cylindrical Lens



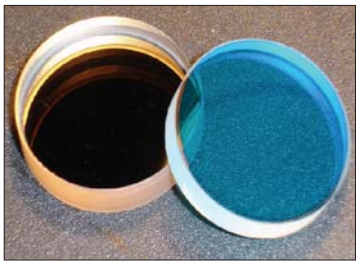
Plano-Convex Cylindrical Lens

Attribute	Specification
Typical Material	On request, for example N-BK7, H-K9L, Fused Silica, N-SF10 etc.
Diameter Tolerance (mm)	±0.2 (General), ±0.05 (High Precision)
Focal Length Tolerance (mm)	±2%
Centration	<3 arc min
Surface Figure X (per 25mm@632.8nm)	λ/2 (General), λ/4 (High Precision)
Surface Figure Y (per 25mm@632.8nm)	2λ (General), λ (High Precision)
Surface Quality	60/40 (General), 10/5 (High Precision)
Bevel (face width x 45^0)	<0.2-0.5mm (General), 0.05-0.2 (High Precision)
Coating	unpon request

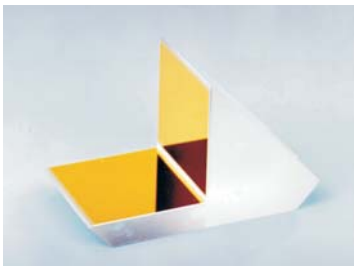
Note: Call for OEM cylindrical lens.

Mirror

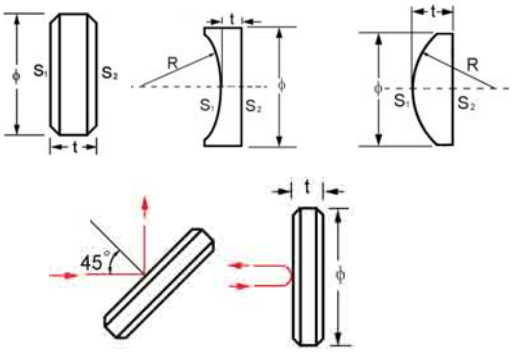
FOCtek offers dielectric coated mirrors and metal coated mirrors which are made of substrate such as N-Bk7, H- K9L, Fused Silica, CaF_2, Sapphire and so on.



Dielectric coated mirror



Metal coated mirror**



45° Incidence angle

0° Incidence angle

Coating Curve of Metal Reflection Coating please refer to Part 5 Coating of this Catalog

Attribute	Specification
Material (1)	N-BK7, H-K9L, Fused Silica, etc.
Typical Diameter (Φmm)(2)	10.0, 12.7, 15.0, 20.0, 25.4, 30.0, 50.8, etc.
Diameter Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.02 (High Precision)
Typical Thickness (mm)(3)	2.0, 3.0, 6.0, 6.35
Thickness Tolerance (mm)	±0.2 (General), ±0.005 (High Precision)
Clear Aperture	>80% (Small Size), >95% (Large Size)
Flatness (per 25mm@633nm)	λ (General), λ/10 (High Precision)
Incidence Angle	0^0 or 45^0
Surface Quality (4)	60/40 (General), 10/5 (High Precision)
Parallelism	3 min. (General), 3 sec. (High Precision)
Bevel (face width x 45^0)	<0.25mm
Coating (5)	Dielectric coated AR, HR, PR or metal coated Al, Ag, Au etc.

Note for Mirror:

(1). Other optical glass or optical crystals of Mirrors are available.

(2). Custom-made Mirrors at any size from diameter 2mm to diameter 300mm and with shape of quadrate, triangular or other polygonal are available upon request.

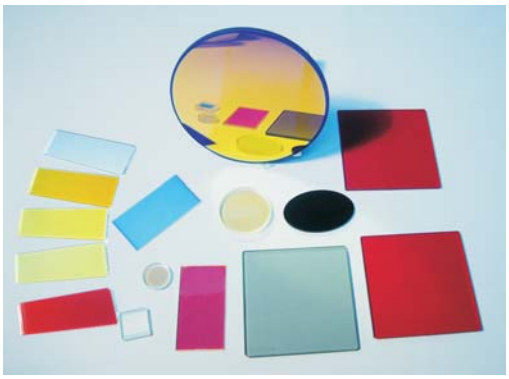
(3). Thickness from 1mm to 20mm are available upon request.

(4). Typical surface quality is 60/40, better precision such as 40/20,10/5 is available upon request.

(5). Please refer to Part 5 for Coating.

Colored Glass Filter Applications

Photographing Apparatus
Meter and Instrument
Optical Device
Medical Treatment Apparatus
Teaching Apparatus
UV Analyzer
Financial Equipment
Airport Lamps
Military Equipment
Technological Research Institute
Public Security Department



Colored Glass Filter Type Table

Cut-Off Type Colored Filter Glass	Selective Absorption Colored Optical Filter Glass		Neutral Filter Glass
Ultraviolet Glass	Ultraviolet Glass	Infrared Glass	Neutral Grey Colored Ultraviolet Glass
Golden(Yellow)Glass	Violet Glass	Protective Glass	
Orange Glass	Blue Glass	Heat-absorbing Glass	
Red Glass	Green Glass	Multiband Calibration Glass	
Infrared Glass	Golden(Yellow) Glass	Sky-light Glass	
	Orange Glass	Rising Color Temperature Glass	
	Red Glass	Falling Color Temperature Glass	

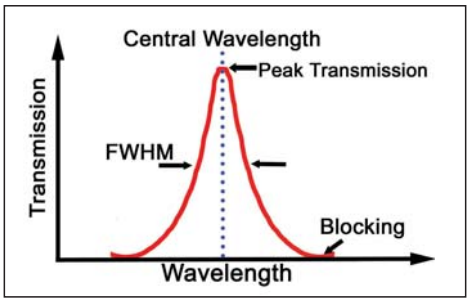
Note: Please visit our web for detailed specifications of each kind of Colored Glass Filter.

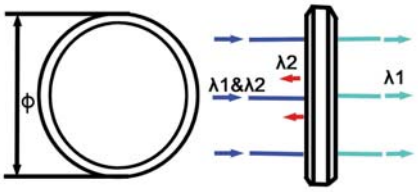
Fabricating Specifications

Attribute	Specification
Material	colored glass filter
Dimension Tolerance (mm)	+0.0/-0.2 (General), +0.0/-0.05 (High Precision)
Thickness Tolerance (mm)	±0.2 (General), ±0.05 (High Precision)
Clear Aperture	>80% (Small Size), >95% (Large Size)
Parallelism	1 min. (General), 3 sec. (High Precision)
Surface Quality	60/40 (General), 10/5 (High Precision)
Flatness (per 25mm@633nm)	λ (General), λ/10 (High Precision)
Bevel (face width x 45°)	<0.25mm
Coating	Uncoated, Dielectric AR Coating, Dichroic Filter Coating, etc.

Interference Filter Applications

Biomedical
Fluorescence Microscope
Laser System
Inspection Apparatus
Selective Interference
Hg Lamp Spectrum
Analyzing Spectrum
Imaging Optics Systems





Interference Filter Specifications

Attribute	Specification
Material	Colored glass filter or optical coating glass
Typical Diameter (Φmm)(1)	12.0, 15.0, 25.0, 25.4, etc.
Typical Thickness (mm)(2)	2.0 ～ 10.0
Dimension Tolerance (mm)(3)	±0.2
FWHM (nm)(4)	10 ～ 80
Wavelength Tolerance (nm)(5)	±2 (10nm FWHM)
Surface Quality(6)	80/50 (General), 40/20 (High Precision)
Wavelength (nm)(7)	220, 254, 265, 280, 295, 313, 340, 365, 405, 340, 380, 400, 405, 430, 450, 492, 497, 510, 524, 530, 546, 550, 555, 578, 590, 592, 600, 612, 620, 630, 690, 700, 750, etc.

Note for Interference Filter:

(1). Custom-made diameter is available, Custom-made shape of interference filter is available.
(2). Typical thickness is from 2.0mm to 5.0mm, custom-made thickness from 2.0mm to 10.0mm is available.
(3). Typical dimension tolerance is ±0.2mm, better precision is available upon request.
(4). Typical FWHM (transmitted wavelength range, as defined by the Full Width Half Maximum of transmission curve) from 10nm to 80nm, broadband from 1nm to 100nm are available upon request.
(5). Typical wavelength tolerance is ±2nm when FWHM is 10nm, better precision is available upon request
(6). Typical surface quality is 80/50, better precision such as 60/40, 40/20 is available upon request.
(7). Wavelength is various due to different applications, they are UV (200nm−399nm), VIS (400nm-700nm), IR (750nm-2500nm), Please tell us your special use wavelength.

Neutral Density Filter

Neutral density filters attenuate, split or combine beams in a range of irradiance ratios with little dependence on wavelength.

FOCtek offers two kinds of neutral density filters, which are neutral grey glass type filters and metallic coated type filters made of optical glass such as N-BK7, H-K9L Fused Silica and so on.

The thickness of neutral grey glass type filters determin the transmission, however, transmission is determined by coating thickness in the metallic coated optical material type.

Neutral Density Filter Specifications

Attribute	Specification	
	Neutral Density Glass Type	Metallic Coating Type
Material	Optical Neutral Density Glass	N-BK7, H-K9L, Fused Silica
Typical Size (mm) (1)	Φ25.0, 50.0 x 50.0	Φ25.0 x 2.0, 50.0 x 50.0 x 2.0
Size Tolerance (mm) (2)	±0.2	
Parallelism (3)	3 arc min.	
Flatness (per 25mm@633nm) (4)	2 λ (General), λ /2(High Precision)	
Surface Quality (5)	80/50 (General), 20/10 (High Precision)	
Optical Density (6)	0.04, 0.1, 0.2, 0.3, 0.4, 0.5, 0.8, 1.0, 2.0, 3.0, 4.0, etc.	0.1, 0.2, 0.3, 0.5, 0.8, 1.0, 2.0, 3.0, 4.0, etc.
Optical Density Tolerance	±5%	

Note for Interference Filter:

(1). Typical diameter is phi 10.0mm, 15.0mm, 20.0mm, 25.4mm, other size at shape of quadrate, triangular, or other polygonals are available upon request.

(2). Typical size tolerance is ±0.2mm, better precision is available upon request.

(3). Typical parallelism is 3 arc minutes, better parallelism is available upon request

(4). Typical flatness is 2λ, high precision such as λ/2 is available upon request.

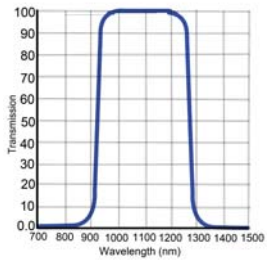
(5). Typical surface quality is 80/50, better precision such as 60/40, 40/20, 20/10 is available upon request.

(6). Optical density (D) is defined as the base 10 logarithm of the reciprocal of transmittance (T): $D=\log(1/T)$ or $T=10^{(-D)}$, Besides the typical optical density listed as above, others are available upon request.

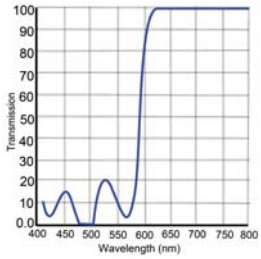
Dielectric Coating Filter

FOCtek offers dielectric coating filters made of optical materials such as Colored Glass, N-BK7, H-K9L, Fused Silica, Sapphire and so on.

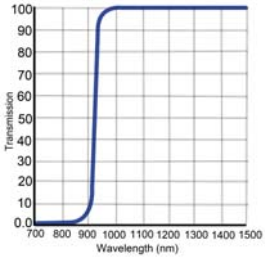
The dielectric coating filters include bandpass filters, dichroic filters, longpass filters and shortpass filters. The transmissive rang of wavelength is customized and high transmission at specified wavelength is available upon request.



Bandpass Filter



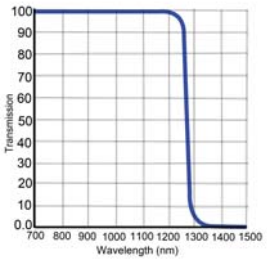
Dichroic Filter



Longpass Filter

Specifications

Attribute	Specification
Material(1)	Optical glass
Typical Diameter (Φmm)(2)	10.0, 12.7, 15.0, 20.0, 25.4, etc.
Typical Thickness (mm)	0.2 ～ 20.0
Dimension Tolerance (mm)	±0.2 (General), +0.0/-0.05 (High Precision)
Surface Quality	80/50 (General), 40/20 (High Precision)
Wavelength (nm)(3)	Upon request
Coating(4)	Dielectric coated AR, HR, PR, etc.



Shortpass Filter

Note for Dielectric Coating Filter:

(1). Optical glass such as Colored Glass, N-BK7, H-K9L, B270 Fused Silica, Sapphire and so on.

(2). Dielectric Coating Filter at any size with shape of quadrate, triangular, or other polygonal are available

(3). Wavelength range such as UV (200nm−399nm), VIS (400nm-700nm), IR (750nm-2500nm) is available.

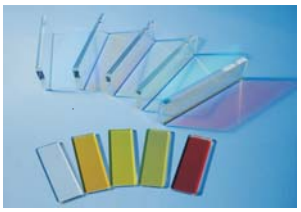
(4). Please refer to Part 5 for more information about Coating.

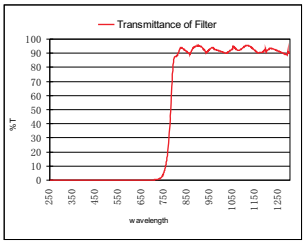
IPL Filter

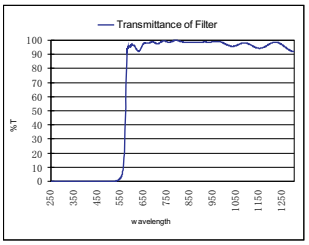
IPL filter is the key optical element for IPL (Intense Pulsed Light) machine, which filters the UV wave and reserve the useful wave from 400nm to 1200nm for cosmetic laser, such as photrevujenation, hair removal, vascular and acne treatment. The IPL Filters include **IPL Internal Filters** and **IPL External Filters**.

IPL Filter Typical Specifications

Attribute	Specification
Material	N-BK7, H-K9L, Fused Silica, Sapphire etc.
Dimension Tolerance (mm)	±0.1 (General), ±0.01 (High Precision)
Thickness Tolerance (mm)	±0.2 (General), ± 0.005 (High Precison)
Surface Quality	60/40 or Better
Clear Aperture	>90%
Parallelism	<3 arc min. (General), <5 arc sec. (High Precison)
Wavefront Distortion(per 25mm@633nm)	<λ/2 (General), λ/8 (High Precison)
Bevel (face width x 45°)	0.2-0.5mm
wavelength (nm)	515-1200, 530-1200, 550-1200, 560-1200, 570-1200, 590-1200, 615-1200, 615-1200, 695-1200, 755-1200, 780-1200





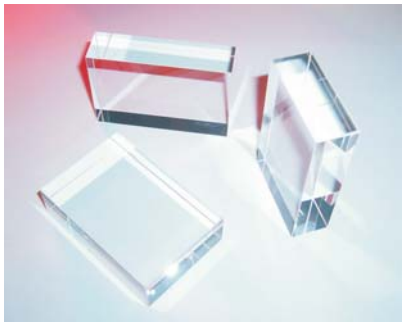


IPL Light Guide

FOCtek supplies the IPL light guide with all surfaces polished by advanced polishing technic. The high surface quality as 20/10, flatness better than λ/10 is achievable. This special polished products can be made of materials such as N-BK7, Fused Silica and so on.

***IPL Filter Coating on IPL Light Guide is available.**

Attribute	Specifiction
Material	N-BK7, H-K9L, Fused Silica, Sapphire etc.
Dimension Tolerance (mm)	±0.1 (General), +0.0/-0.01 (High Precision)
Surface Quality	60/40 (General), 20/10 (High Precision)
Clear Aperture	>90% (General), >97% (High Precision)
Parallelism	<1arc min. (General), <10arc sec.(High Precision
Flatness (per 25mm@633nm)	<λ/2 (General), <λ/10 (High Precision)
Bevel (face width x 45°)	<0.25mm (General), No Bevel (High Precision)
Chip (mm)	<0.2 (General), <0.05 (High Precision)



Note: FOCtek provides a wide variety of custom design IPL Products upon request

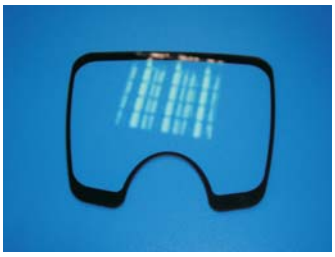
1、Custom Size is available upon request

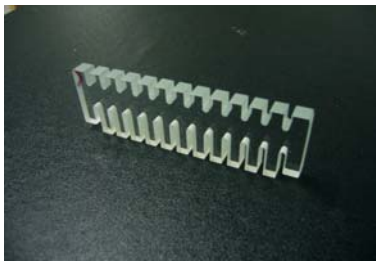
2、Custom coated wavelength is available upon request

3、Custom made mounter for the IPL Products is available

Special Shape Optics

By using the special fabricating method,
CNC grinding and polishing machines,
Foctek offers the custom-made special shape optics.



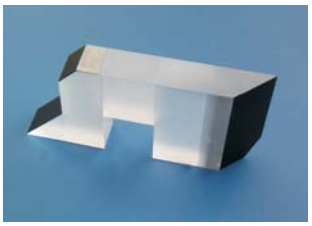


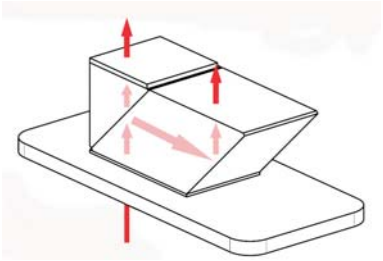
Fabricating Specifications

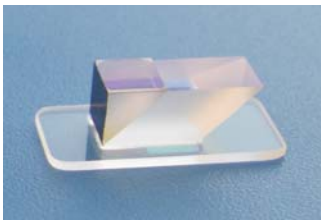
Attribute		Specification
Material		All kinds of high quality optical glass, N-BK7, H-K9L, Fused Silica etc.
Dimension Tolerance (mm)		±0.15 (General), ±0.05 (High Precision)
Angle Tolerance		±0.2 deg. (General), ±10 arc sec. (High Precision)
Surface Quality		60/40 (General), 20/10 (High Precision)
N	For Flat Surface	1 (General), 0.2 (High Precision)
	For Spheric Surface	8 (General), 2 (High Precision)
△N	For Flat Surface	0.5 (General), 0.1 (High Precison)
	For Spheric Surface	2 (General), 0.5 (High Precison)

Optical Cemented Components

Foctek designs and manufactures high quality and precision optical cemented components to customers. Special cementing technology, unique adhesive systems, advanced production and inspection facility are our main advantages of making optical cemented components. Foctek's cemented components are manufactured keeping in mind many of the cementing problems that are prevalent in the optical industry.







Fabricating Specifications

Attribute	Specification
Material	All kinds of high quality optical glass, like N-BK7, H-K9L, N-SF11 etc.
Dimension Tolerance (mm)	± 0.2 (General), ±0.05 (High Precision)
Beam Deviation	3' (General), 3" (High Precision)
Angle Tolerance	±0.2 deg. (General), ±10 arc sec. (High Precision)
Surface Quality	60/40 (General), 20/10 (High Precision)

Note: FOCtek provides a wide variety of Optical Cemented Components upon request

PART 2

OPTICAL ASSEMBLY


1/3 CCTV CS
ASPHERICAL
IR
CCTV LENS
DIRECT DRIVE

Optical Assemblies

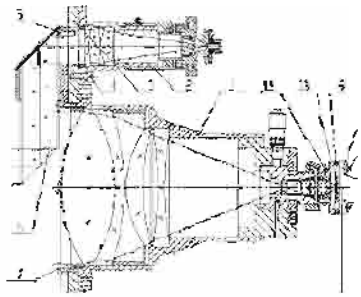
Foctek has strong capabilities in Optical Design, Mechanical Design and Optical Assembly. With integrated optical and mechanical design, fabrication, assembly, advanced metrology, more than 10 years' optical cementing experiences and 6 years' optical assembly experiences, Foctek is not only providing the advanced optical assemblies according to customer's design, but also provide the design services for our customer.

Optical Assemblies	Illustration
Lenses Assembies	
Precision Optics Assemblies (Prisms, Windows, filters, Beamsplitters, etc.)	
CCTV Lenses NEUSION Machine vision, CCTV, Optics	
Machine Vision Lenses NEUSION Machine vision, CCTV, Optics	
Automotive Camera Lenses	

Continue >>>

ODM, OEM

- Optical Assembly Design And Manufacture service
- Optical Lens Design Service
- Custom-Made Lens



Trioptics ImageMaster MTF Measurer

- Full FOV MTF measuring
- Range: 450-950nm
- EFL, FFL measuring
- Distortion measuring
- Field Curvature measuring
- Astigmatism measuring
- Chromatic Aberration measuring

Trioptics ImageMaster MTF Measurer

Notes:

1. Refer to "Neusion Lens" Catalog for Standard CCTV Lenses & Machine Vision Lenses.
2. Refer to" Automotive Camera Lenses" Catalog for Automotive Camera Lenses.
3. Visit www.neusion-lens.com for CCTV Lenses & Machine Vision Lenses, Automotive Camera Lenses.

PART 3

POLARIZATION OPTICS

Birefringent Crystals Material

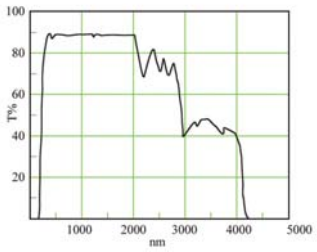
FOCtek manufactures a wide range of polarization optics, include Polarizer (Glan Taylor, Glan Laser, Glan Thompson, Wollaston and Rochon), polarization beam combiner, waveplate, polarization rotator, Depolarizer by adopting Birefringent crystals of a-BBO, calcite, YVO_4, quartz and MgF_2.

α-BBO is characterized by large birefringent coefficient and wide transmission window from 189nm to 3500nm, particularly suitable for high power UV polarizer (200-300nm). But, its high hygroscopic susceptibility increases the difficulty of fabricating.

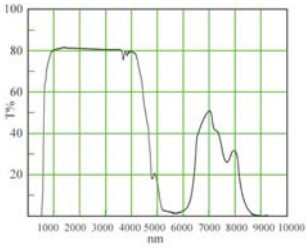
Calcite is a natural minded crystal and the most common crystals for polarizers used as visible and near IR polarizers. Defects of natural minded crystal, such as bubbles, striae, optical inhomogeneity and stress birefringence, cause degradation of polarization and transmission loss . That is why the extinction of the polarizer is not as high as synthetically grown material YVO_4, α-BBO.

YVO4 crystal has been widely used in fiber optical components due to its large birefringence, good physical and favorable mechanical properties. Since the crystal has high transmission from 500 to 3500 nm, it is recommended to use YVO_4 polarizer for IR application.

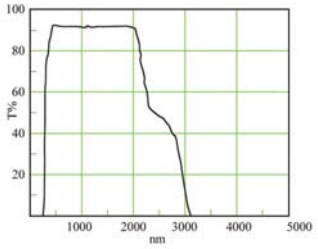
Crystal Quartz has optical activity, It rotates the polarization plane of linearly polarized beam when the beamtravel along the crystal optic axis. Because of its low birefringence, it is not feasible to fabricate Glan type polarizer, but suitable for Rochon or wollaston. And it is a excelent material for waveplate.



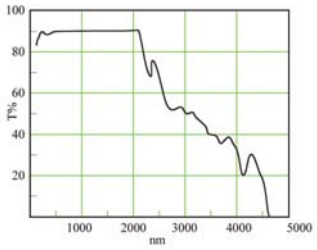
α-BBO: T% vs Wavelength



YVO_4: T% vs Wavelength



Calcite: T% vs Wavelength



Quartz: T% vs Wavelength

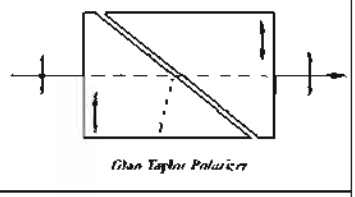
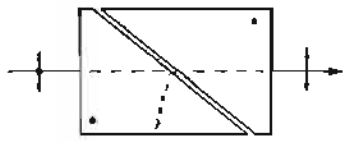
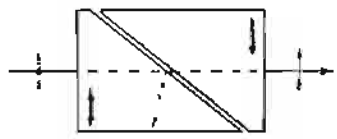
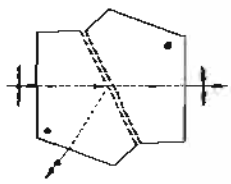
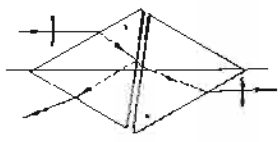
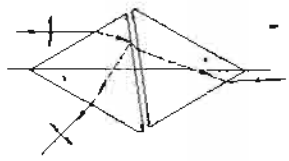
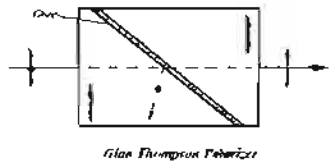
MgF_2 Crystal has very wide transmission range from 110 nm to 8500nm. It is the best material for DUV application. Same reason of its low birefringence, MgF_2 is not feasible to fabricate Glan type polarizer, but suitable for Rochon or wollaston. MgF_2 is also used for waveplate, and commonly works together with quartz to make achromatic waveplate

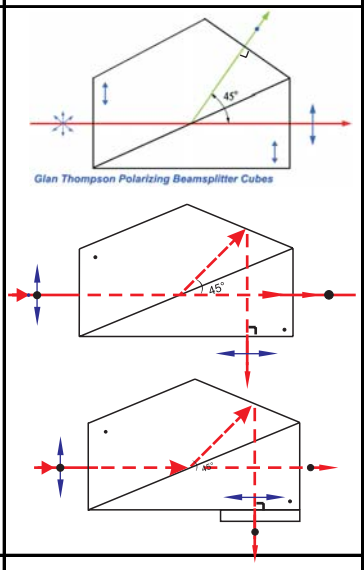
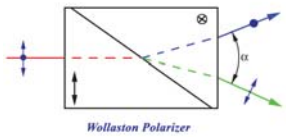
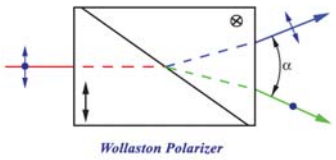
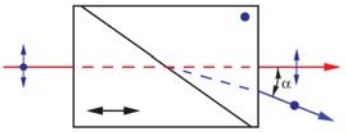
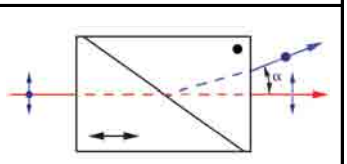
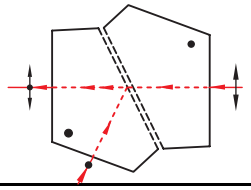
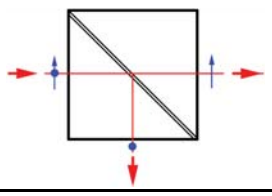
Comparison of main properties of the materials listed below:

	YVO_4	Calcite	α-BBO	Quartz	MgF_2
Transparency	400-5000nm	350-2300nm	189-3500nm	200-2300nm	110-8500nm
Crystal Class(Uniaxial)	Positive $n_o = n_a = n_b, n_e = n_c$	Negative $n_o = n_a = n_b, n_e = n_c$	Negative $n_o = n_a = n_b, n_e = n_c$	Positive $n_o = n_a = n_b, n_e = n_c$	Positive $n_o = n_a = n_b, n_e = n_c$
Mohs Hardness	5	3	4.5	7	6
Thermal Expansion Coefficient	$\alpha_a=4.43\times10^{-6}$/k $\alpha_c=11.37\times10^{-6}$/k	$\alpha_a=24.39\times10^{-6}$/k $\alpha_c=5.68\times10^{-6}$/k	$\alpha_a=4\times10^{-6}$/k $\alpha_c=36\times10^{-6}$/k	$\alpha_a=6.2\times10^{-6}$/k $\alpha_c=10.7\times10^{-6}$/k	$\alpha_a=9.5\times10^{-6}$/k $\alpha_c=14.3\times10^{-6}$/k
Hygroscopic Susceptibility	NO Hygroscopic	Low to Moisture	High	NO Hygroscopic	NO Hygroscopic
Refractive Index(633nm)	$n_o=1.9928$ $n_e=2.2153$	$n_o=1.6558$ $n_e=1.4852$	$n_o=1.6706$ $n_e=1.5483$	$n_o=1.5427$ $n_e=1.5518$	$n_o=1.37698$ $n_e=1.38876$

Polarizer

A polarizer is an important optical component that is widely used in laser systems to generate the linear polarization laser. Foctek makes following polarizers with five materials, a-BBO, Calcite and YVO_4, Quartz MgF_2, suitable for the widest spectrum and high polarization purity applications.

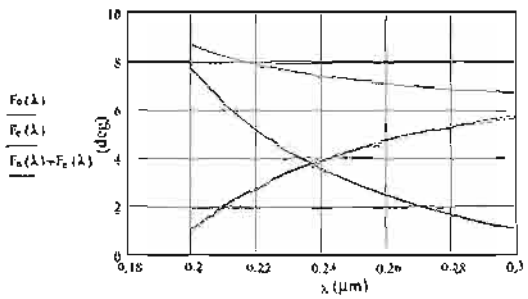
Polarizer	Material	Illustration	Properties and Application
Glan-Taylor Polarizer	α-BBO (200-3500nm) Calcite (350-2300nm)	 Glan Taylor Polarizer	•Air Spaced •Close to Brewster's Angle Cutting •Low L/A •Mounted without escape windows •For low to medium power application
	YVO4 (400-5000nm)		
Glan-Laser Polarizer	α-BBO (200-3500nm) Calcite (350-2300nm)		•Air Spaced •Close to Brewster's Angle Cutting •Mounted with escape windows •Suitable for high power application •Low L/A
	YVO4 (400-5000nm)		
High Transmission Glan-Laser Polarizer	YVO4 (400-5000nm)		•Air Spaced •Brewster's Angle Cutting •Mounted with escape windows •Suitable for high power and high transmission application •Brewster Angle input
	Calcite (350-2300nm)		
Glan Thompson Polarizer	α-BBO (220-1100nm) (200-3300nm) Calcite (350-2300nm)	 Glan Thompson Polarizer	•Cemented •Suitable for low power application •Wide acceptance angle field

Polarizer	Material	Illustration	Properties and Application
Glan Thompson Polarizing Beamsplitter Cube	Calcite (350-2300nm)		◆Cemented ◆Suitable for low power application ◆Wide acceptance angle field ◆Split o-ray & e-ray at 45° or 90° ◆Also can work as polarization Beam combiner
Wollaston Polarizer	YVO4 (400-5000nm) Quartz(200-2300nm) MgF2(130-6000nm)		◆Cemented ◆Separate ordinary and extraordinary beams at certain angle ◆Suitable for low power application and where the large deviation is required
	α-BBO(200-3500nm) Calcite(350-2300nm)		
Rochon Polarizer	α-BBO(200-3500nm)		◆α-BBO is used to guarantee a wide transmission range ◆Especially, suitbale for UV application ◆Split the ordinary and extraordinary ray, but only ordinary beam is deviated
	YVO4 (400-5000nm) MgF2 (130-6000nm) Quartz (200-2300nm)		
BroadBand Polarization Combiner	YVO4 (400-5000nm)		◆Air Spaced ◆For Hight power Application ◆Broad Band From 500-5000nm
Polarization Beamsplitter	N-BK7 Grade A Optical Glass or N-SF_2 Optical Glass		◆Split the ordinary and extraordinary ray. The ordinary beam is deviated 90 ° Refer to chapter "Beamsplitter" for detailed information

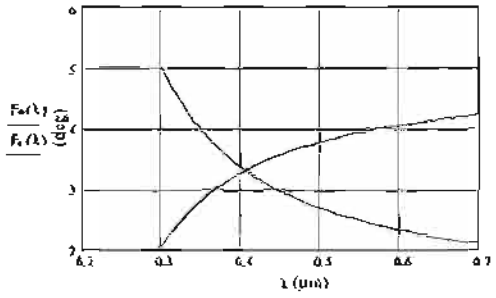
Glan Taylor Polarizer

Glan Taylor polarizer is made of two same birefringent material prisms that are assembled with an air space. It has a length to aperture ratio less than 1.0 makes it a relatively thin polarizer. The polarizer with no side escape windows are suitable for low to medium power application where the side rejected beams are not required, which is suitable for a wide variety of applications, particularly with collimated input beams. The angular field of different materials of polarizers listed below for comparison.(Fo for o-ray; Fe for e-ray)

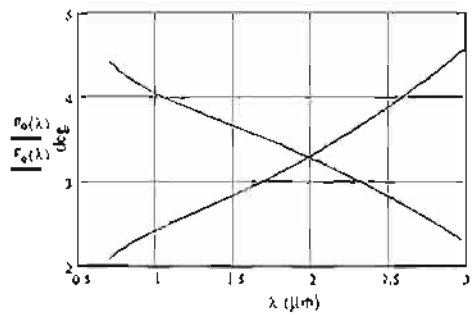
Angular Field vs wavelength



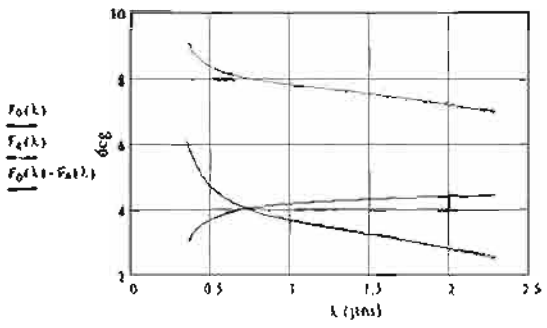
α-BBO, 200-300 nm



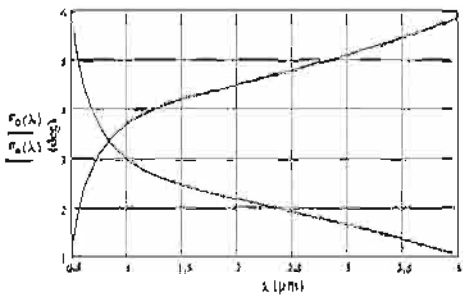
α-BBO, 300-700 nm



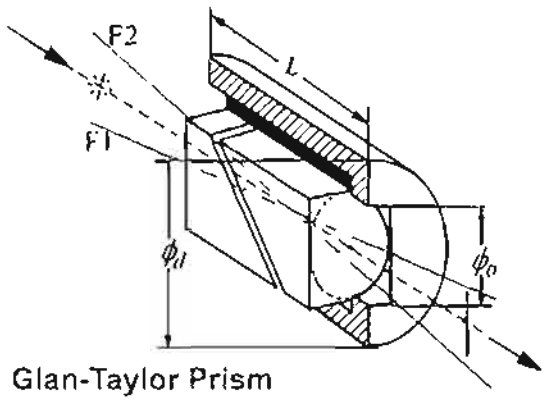
α-BBO, 700-3000nm



Calcite, 350-2300 nm



YVO_4, 500-4000 nm



Glan-Taylor Prism

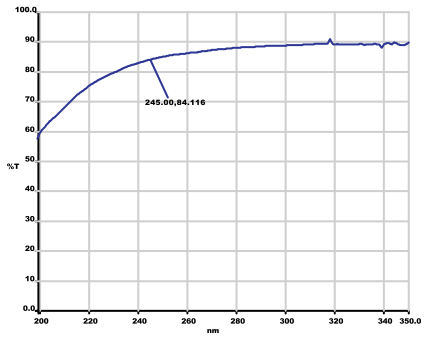
Features:

- Air-spaced
- Close to Brewster's Angle Cutting.
- High Polarization Purity.
- Short Length.
- Suitable for low to medium power application where the rejected beam is not required.

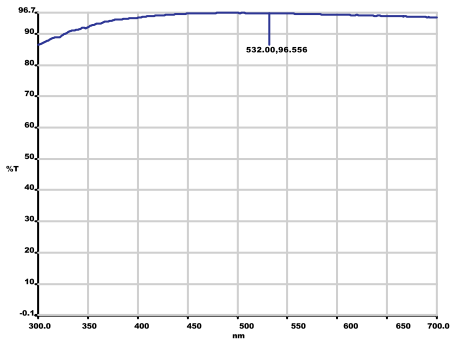
Specifications:

Material	:	a-BBO, Calcite or YVO_4
Wavelength Range	:	α**-BBO:** 200-3500 nm, **Calcite:** 350-2300 nm **YVO_4:** 400-5000 nm
Extinction Ratio	:	**Calcite:**<$5x10^{-5}$; α**-BBO:**<$5x10^{-6}$; **YVO_4:**<$5x10^{-6}$
Surface Quality	:	20-10
Beam Deviation	:	< 3 arc minutes
Flatness	:	λ/4@633nm
Damage Threshold	:	>200 MW/cm^2
Coating	:	Single Layer MgF_2
Mount	:	Black Anodized Aluminium

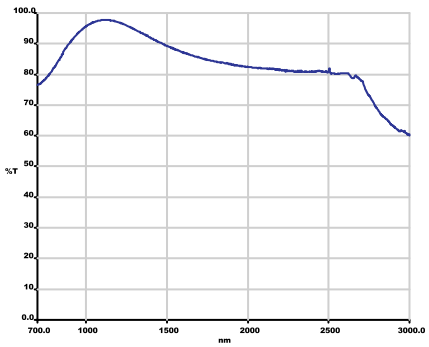
Transmission (T%) vs wavelength



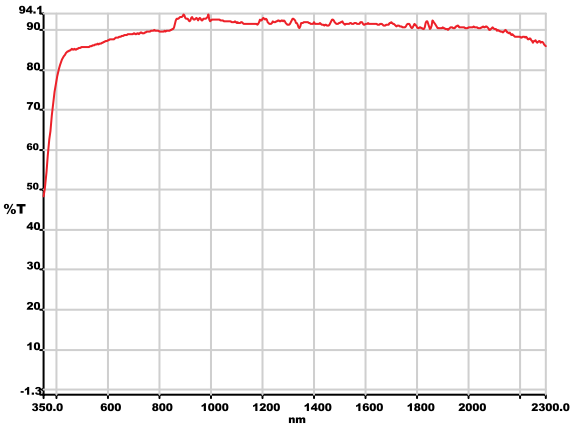
α-BBO 200-270nm (GTP6200)



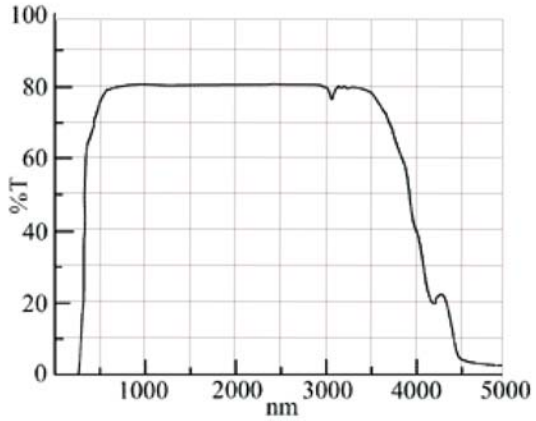
α-BBO 300-700nm (GTP6300)



α-BBO 700-3000nm (GTP6700)



Calcite 350-2300nm



YVO_4 400-5000nm

Standard Products

1. α-BBO Glan Taylor Polarizer

P/N #	Wavelength Range (nm)	Extinction Ratio	Angular Field (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
GTP6206	200-270 (Single Layer MgF2) (Coating@245nm)	<5 x 10^{-6}	>6.0°	5.0	15.0	8.0	$199.0
GTP6208				7.0	25.4	10.0	$239.0
GTP6210				9.0	25.4	11.0	$299.0
GTP6215				13.5	30.0	15.0	$499.0
GTP6220				18.0	38.0	19.0	$789.0
GTP6306	300-700 (Single Layer MgF2) (Coating@532nm)	<5 x 10^{-6}	>6.0°	5.0	15.0	8.0	$199.0
GTP6308				7.0	25.4	10.0	$239.0
GTP6310				9.0	25.4	11.0	$299.0
GTP6315				13.5	30.0	15.0	$499.0
GTP6320				18.0	38.0	19.0	$789.0
GTP6706	700-3000 (Single Layer MgF2) (Coating@1064nm)	<5 x 10^{-6}	>6.0°	5.0	15.0	8.0	$199.0
GTP6708				7.0	25.4	10.0	$239.0
GTP6710				9.0	25.4	11.0	$299.0
GTP6715				13.5	30.0	15.0	$499.0
GTP6720				18.0	38.0	19.0	$789.0

2. Calcite Glan Taylor Polarizer

P/N #	Wavelength Range (nm)	Extinction Ratio	Angular Field (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
GTP7006	350-2300 (Single Layer MgF2) (Coating@1064nm)	<5 x 10^{-5}	>7.7°	5.0	15.0	8.0	$189.0
GTP7008				7.0	25.4	10.0	$229.0
GTP7010				9.0	25.4	11.0	$279.0
GTP7015				13.5	30.0	15.0	$399.0
GTP7020				18.0	38.0	19.0	$669.0

3. YVO_4 Glan Taylor Polarizer

P/N #	Wavelength Range (nm)	Extinction Ratio	Angular Field (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
GTP8006	500-4000 (Single Layer MgF2) (Coating@1300nm)	<5 x 10^{-6}	>6.5°	5.0	15.0	7.0	$169.0
GTP8008				7.0	25.4	9.0	$219.0
GTP8010				9.0	25.4	10.0	$299.0
GTP8015				13.5	30.0	12.0	$509.0
GTP8020				18.0	38.0	15.0	$779.0

Note: Price list is for quantity <=5 pcs.

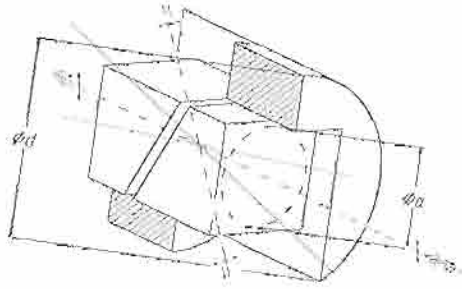
Call for OEM quantity pricing, AR coated and Custom Design Polarizer.

Glan Laser Polarizer

Glan Laser polarizer is made of two same birefringent material prisms that are assembled with an air space. The polarizer is a modification of the Glan Taylor type and is designed to have less reflection loss at the prism junction. The polarizer with two escape windows allow the rejected beam to escape out of the polarizer, which makes it more desirable for high energy lasers. The surface quality of these faces is relatively poor as compared to that of entrance and exit faces. No scratch dig surface quality specifications are assigned to these faces.

Angular Field vs wavelength

Please refer to Page 44 Glan Taylor Polarizer.



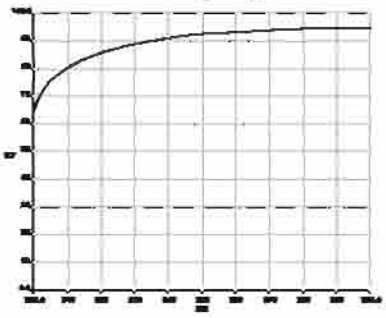
Glan-Laser Prism

Features:

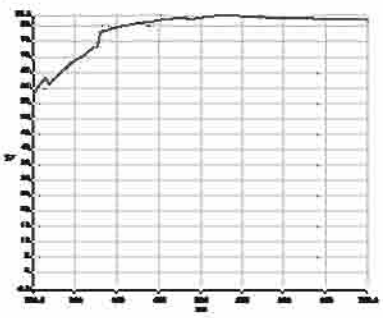
- Air Spaced.
- Close to Brewster's angle Cutting.
- Mounted with escape windows.
- High Polarization purity.
- Suitable for high power applications.

Material	:	α-BBO, Calcite or YVO_4
Wavelength Range	:	**α-BBO:** 200-3500 nm, **Calcite:** 350-2300 nm **YVO_4**:400-5000 nm
Extinction Ratio	:	Calcite:<$5x10^{-5}$; α-BBO:<$5x10^{-6}$; YVO_4:<$5x10^{-6}$
Surface quality	:	20-10
Beam Deviation	:	< 3 arc minutes
Flatness	:	λ/4@633nm
Damage Threshold	:	>500 MW/cm²
Coating	:	Single Layer MgF_2
Mount	:	Black Anodized Aluminium

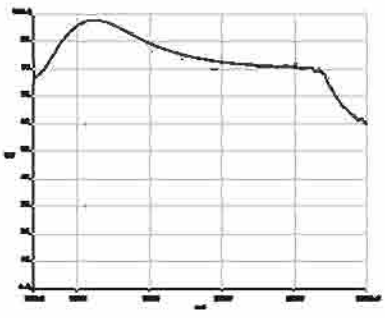
Transmission (T%) vs wavelength



α-BBO: 200-300 nm (GLP 6200)



α-BBO: 300-700 nm (GLP6300)



α-BBO: 700-3000 nm (GLP6700)

Standard Products

1. α-BBO Glan Laser Polarizer

P/N #	Wavelength Range (nm)	Extinction Ratio	Angular Field (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
GLP6206	200-270 (Single Layer MgF_2) (Coating@245nm)	<5 x 10^{-6}	>6.0°	5.0	15.0	12.0	$269.0
GLP6208				7.0	25.4	15.0	$299.0
GLP6210				9.0	25.4	20.0	$399.0
GLP6215				13.5	30.0	25.0	$589.0
GLP6220				18.0	38.0	34.0	$839.0
GLP6306	300-700 (Single Layer MgF_2) (Coating@532nm)	<5 x 10^{-6}	>6.0°	5.0	15.0	12.0	$269.0
GLP6308				7.0	25.4	15.0	$299.0
GLP6310				9.0	25.4	20.0	$399.0
GLP6315				13.5	30.0	25.0	$589.0
GLP6320				18.0	38.0	34.0	$839.0
GLP6706	700-3000 (Single Layer MgF_2) (Coating@1064nm)	<5 x 10^{-6}	>6.0°	5.0	15.0	12.0	$269.0
GLP6708				7.0	25.4	15.0	$299.0
GLP6710				9.0	25.4	20.0	$399.0
GLP6715				13.5	30.0	25.0	$589.0
GLP6720				18.0	38.0	34.0	$839.0

2. Calcite Glan Laser Polarizer

P/N #	Wavelength Range (nm)	Extinction Ratio	Angular Field (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
GLP7006	350-2300 (Single Layer MgF_2) (Coating@1064nm)	<5 x 10^{-5}	>7.7°	5.0	15.0	12.0	$199.0
GLP7008				7.0	25.4	15.0	$219.0
GLP7010				9.0	25.4	20.0	$269.0
GLP7015				13.5	30.0	25.0	$429.0
GLP7020				18.0	38.0	34.0	$699.0

3. YVO_4 Glan Laser Polarizer

P/N #	Wavelength Range (nm)	Extinction Ratio	Angular Field (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
GLP8006	400-5000 (Single Layer MgF_2) (Coating@1300nm)	<5 x 10^{-6}	>6.5°	5.0	15.0	15.5	$238.0
GLP8008				7.0	25.4	19.0	$319.0
GLP8010				9.0	25.4	22.5	$369.0
GLP8015				13.5	30.0	31.0	$619.0

Note: Price list is for quantity <=5 pcs.

Call for OEM quantity pricing, AR coated and Custom Design Polarizer.

A wide variety of custom design GLAN Laser Polarizer are available upon request

Custom Size Mount is available upon request

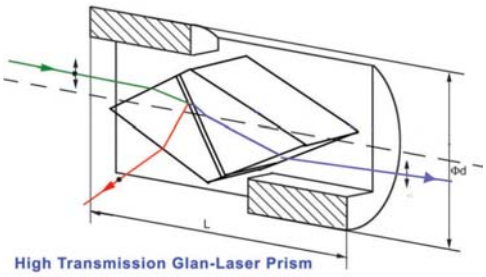
AR coated Polarizer is available upon request

High Transmisson Glan Laser Polarizer

Foctek specially designed a high transmission Glan Laser Polarizer for application which requires high transmission. The specially designed polarizer is based on the Brewster Cut crystal, which can improve the transmission from normally >85% to 95%. This polarizer can be made from both Calcite and YVO_4.

Features:

- Air Spaced.
- All Brewster's angle Cutting.
- Mounted with escape windows.
- High Polarization purity.
- Suitable for high power applications.
- High transmission.
- Brewster angle input.



High Transmission Glan-Laser Prism

Specifications:

Material	:	Calcite or YVO_4
Wavelength Range	:	**Calcite:** 350-2300 nm, **YVO_4:** 400-5000 nm
Extinction Ratio	:	Calcite:<$5x10^{-5}$; YVO4:<$5x10^{-6}$
Surface quality	:	20-10
Beam Deviation	:	< 3 arc minutes
Flatness	:	λ/4@633nm
Damage Threshold	:	>500 MW/cm^2
Coating	:	Uncoated
Transmission	:	>95%
Mount	:	Black Anodized Aluminium

Standard Products

1. Calcite High Transmission Glan Laser Polarizer

P/N #	Wavelength Range (nm)	Extinction Ratio	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)
GLH7006	350-2300	<5 x 10^{-5}	5.0	25.4	11.3
GLH7008			7.0	25.4	14.8
GLH7010			9.0	25.4	18.4

2. YVO_4 High Transmission Glan Laser Polarizer

P/N #	Wavelength Range (nm)	Extinction Ratio	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)
GLH8006	400-5000	<5 x 10^{-6}	5.0	25.4	13.2
GLH8008			7.0	25.4	17.6
GLH8010			9.0	25.4	22.0

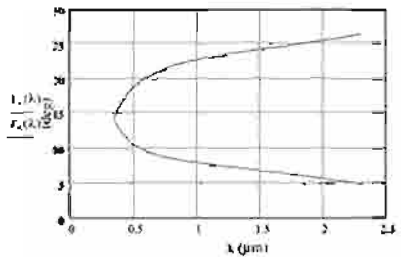
Note: Call for pricing and Custom Design Polarizer.

Glan Thompson Polarizer

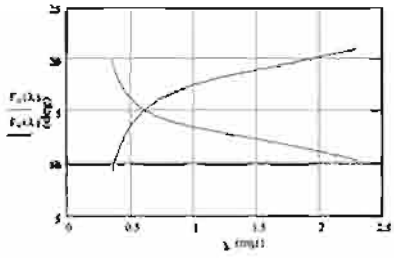
Glan Thompson polarizer is made of two calcite prisms or α-BBO prisms cemented together. Two types of Glan Thompsons are available. One is the standard form and the other is the long form. Their length to aperture ratios are 2.5 : 1 and 3.0 : 1 respectively. Glan Thompsons tend to have higher extinction ratio than air spaced polarizers. In the ultra violet spectrum, their transmission is limited by absorption in birefriengent materials as well as the cement layer. α-BBO polarizers and Calcite polarizers can be used from about 200 to 900nm and 350 to 2300 nm respectively.

The polarizers have the widest field angle of any design. The standard form of this polarizer with 2.5:1 length to aperture ratio has a full acceptance cone angle of more than 15°@ 589nm, symmetric about the input axis, while the long form with 3:1 ratio has a field angle >26° The polarized field Angle Fo and Fe of all these is shown in the plot below.

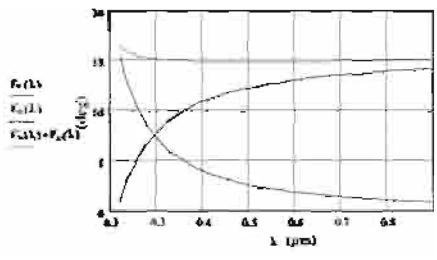
Angular Field vs wavelength



Calcite: L/A=2.5 (350-2300nm)



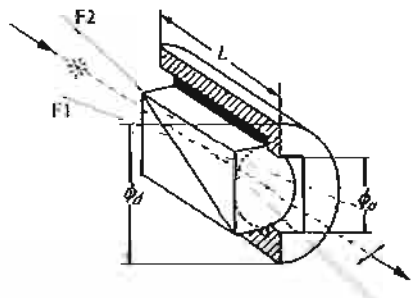
Calcite: L/A=3.0 (350-2300nm)



α-BBO: 200-900 nm

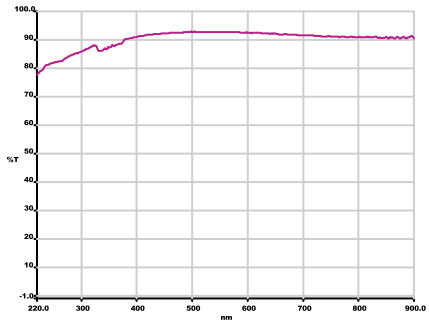
Specifications:

Material	:	α-BBO, Calcite
Wavelength Range	:	**α-BBO:** 200-1100 nm,**Calcite:** 350-2300 nm
Extinction Ratio	:	Calcite:<5x10^{-5} ; α-BBO:<5x10^{-6}
Surface quality	:	20-10
Beam Deviation	:	< 3 arc minutes
Flatness	:	λ/4@633nm
Damage Threshold	:	>200 MW/cm^2
Coating	:	Single Layer MgF_2
Mount	:	Black Anodized Aluminium

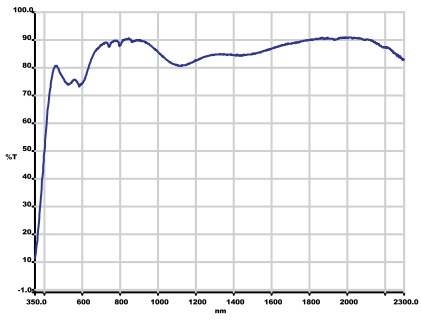


Glan-Thompson Prism

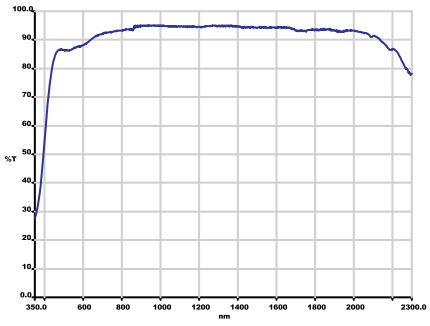
Transmission (T%) vs wavelength



GMP 6010



GMP 7110



GMP 7215

1. α-BBO Glan Thompson Polarizer (Foctek Patent NO.: ZL 2005 1 0018753.6)

P/N #	Wavelength Range(nm)	L/CA	Extinction Ratio	Angular Field (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
GMP6006	200-1100 (Single Layer MgF_2) (Coating@532nm)	1.6	<5 x 10^{-6}	>15°	5.0	15.0	14.0	$299.0
GMP6008					7.0	25.4	17.0	$359.0
GMP6010					9.0	25.4	21.0	$479.0
GMP6012					11.4	25.4	26.0	$599.0
GMP6015					13.5	30.0	31.0	$749.0
GMP6020					18.0	38.0	40.0	$989.0

2. Calcite Glan Thompson Polarizer

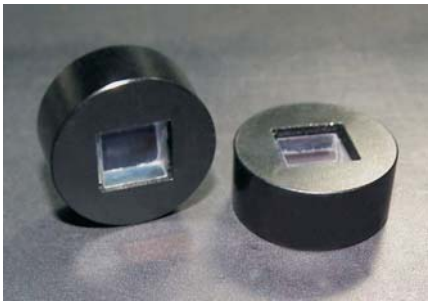
P/N #	L/CA	Extinction Ratio	Angular Field (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
GMP7106	2.5	<5 x 10^{-5}	14°-16°	5.0	15.0	18.0	$229.0
GMP7108				7.0	25.4	23.0	$259.0
GMP7110				9.0	25.4	28.0	$315.0
GMP7112				11.4	25.4	35.0	$389.0
GMP7115				13.5	30.0	41.0	$426.0
GMP7206	3.0	<5 x 10^{-5}	25°-28°	5.0	15.0	21.0	$289.0
GMP7208				7.0	25.4	27.0	$329.0
GMP7210				9.0	25.4	33.0	$399.0
GMP7212				11.4	25.4	41.0	$469.0
GMP7215				13.5	30.0	48.0	$569.0

Note: Price list is for quantity <=5 pcs.

Call for OEM quantity pricing, AR coated and Custom Design Polarizer.

Broadband DUV Polarizer (200-3300nm)

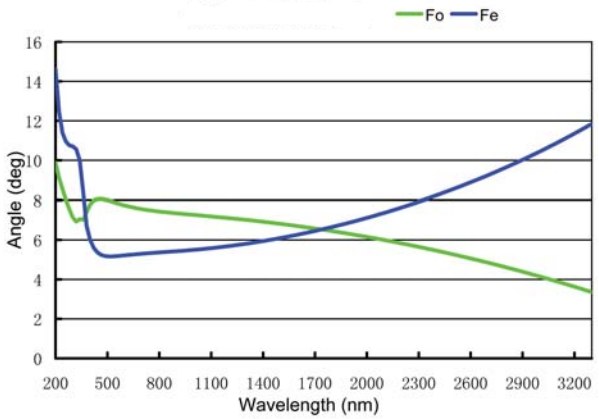
(Foctek Patent NO.: ZL 2005 1 0018753.6)



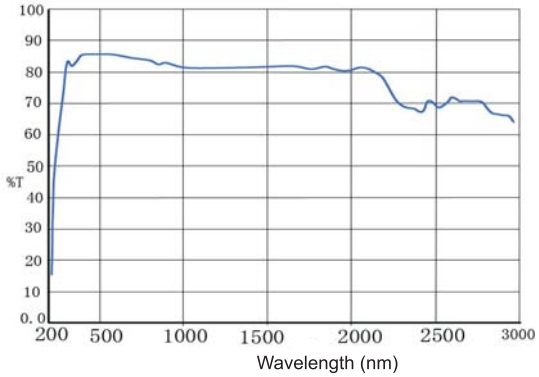
Broadband Glan Thompson Polarizer is made of two a-BBO prisms cemented together. Unlike other types of a-BBO polarizer and Calcite Polarizer which are used from about 200 nm to 900 nm and 350 nm to 2300 nm respectively, this broadband polarizer has a wide rang of wavelength from 200nm to 3300nm.

Also the broadband polarizer has a wide acceptance angle whose field angle Fo and Fe is shown in below figure.

Angular Field vs Wavelength



Transmission (T%) vs Wavelength



Specifications

Material	:	α-BBO
Wavelength Range	:	200-3300 nm
Extinction Ratio	:	<5x10^{-6}
Surface quality	:	20-10
Beam Deviation	:	< 3 arc minutes
Flatness	:	λ/4@633nm
Damage Threshold	:	>200 MW/cm^2
Coating	:	Single Layer MgF_2
Mount	:	Black Anodized Aluminium

Standard Products

P/N#	Extinction Ratio	Angular Field (deg)	CA Øa (mm)	O.D.Ød (mm)	L+/-0.1 (mm)	Unit Price
GMP6206	<5x10^{-6}	see above	5.0	15	14.0	$399.0
GMP6208			7.0	25.4	17.0	$499.0
GMP6210			9.0	25.4	21.0	$629.0
GMP6212			11.4	25.4	26.0	$769.0
GMP6215			13.5	30	31.0	$959.0
GMP6220			18.0	38	40.0	$1199.0

Note: Price list is for quantity <=5 pcs.

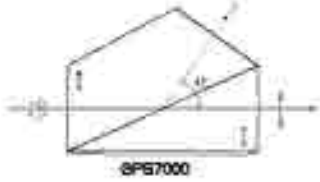
Call for OEM quantity pricing, AR coated and Custom Design Polarizer.

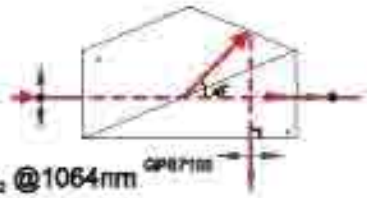
Glan Thompson Polarizing Beamsplitter Cubes

These Glan Thompson polarizers have been arranged to permit the output of the s-polarized beam at 45° or 90° from the straight through p-polarized beam. They provide high polarization purity and high transmission in the two emerging beams. These are useful if it is required to utilize both linear polarization states .

Specifications:

Material	:	Calcite
Wavelength Range	:	Calcite: 350-2300 nm
Extinction Ratio	:	Calcite:<5x10^{-6}
Surface quality	:	20-10
Beam Deviation	:	< 3 arc minutes
Flatness	:	λ/4@633nm
Damage Threshold	:	>500 MW/cm^2
Coating	:	Single Layer MgF_2 @1064nm
Mount	:	Black Anodized Aluminium


GPB7000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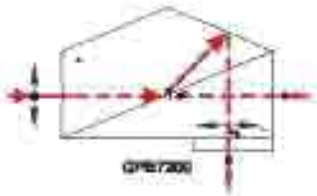
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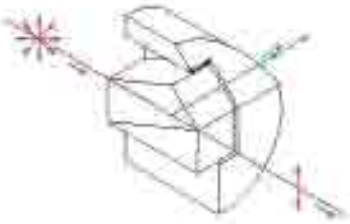
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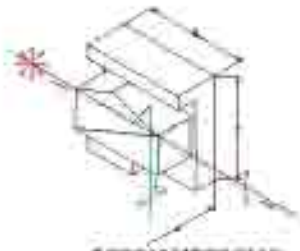

GPB7100/GPB7200

Calcite Glan Thompson Polarizing Beamsplitter Cubes

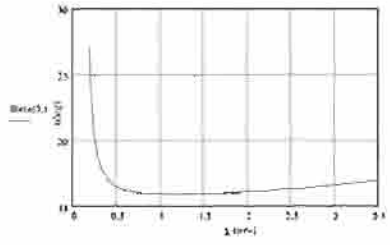
P/N #	Extinction Ratio	Angular Field (deg)	CA Φe (mm)	O.D. Φd (mm)	L+/-0.1 (mm)
GPB7006	<5 x 10^{-6}	14°16'	5.0	50.8	33.0
GPB7008			7.0	50.8	33.0
GPB7010			9.0	50.8	33.0
GPB7012			10.8	50.8	33.0
GPB7015			13.5	50.8	38.0

P/N #	Extinction Ratio	Angular Field (deg)	W+/-0.1 (mm)	H+/-0.1 (mm)	L+/-0.1 (mm)	CA Φe (mm)
GPB7106	<5 x 10^{-6}	14°16'	12.0	16.0	16.0	5.0
GPB7108			16.0	20.0	22.0	7.0
GPB7110			20.0	25.0	26.0	9.0
GPB7112			20.0	30.0	34.0	10.8
GPB7115			25.0	35.0	40.0	13.5
GPB7206	<5 x 10^{-6}	14°16'	12.0	16.0	16.0	5.0
GPB7208			16.0	20.0	22.0	7.0
GPB7210			20.0	25.0	26.0	9.0
GPB7212			20.0	30.0	34.0	10.8
GPB7215			25.0	35.0	40.0	13.5

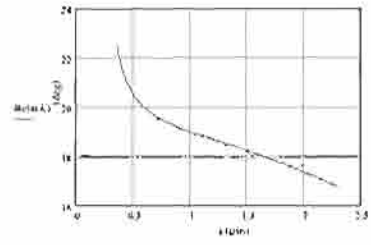
Wollaston Polarizer

Wollaston polarizer is made of two birefringent material prisms that are cemented together. The deviations of the ordinary and extraordinary beams are nearly symmetrical about the input beam axis, so that the Wollaston polarizing beam splitter has approximately twice the deviation of the Rochon. The separation angle exhibits chromatic dispersion, as shown in the blow. Any separation angle can be designed upon the requirement. The separation angle of standard products vs wavelength is shown in the plot below.

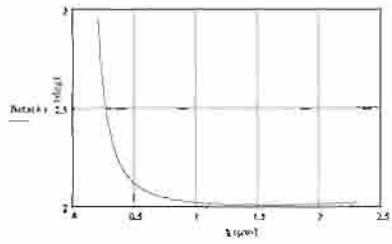
Separation Angle of Standard Products vs wavelength



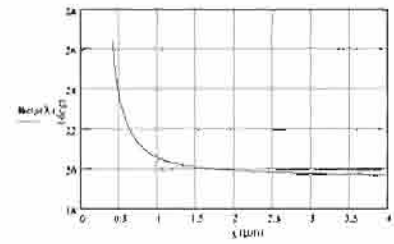
α-BBO: 190-3500 nm



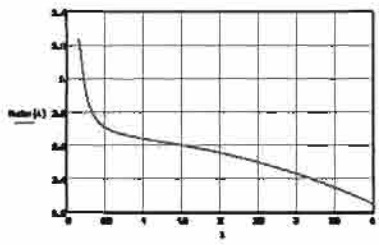
Calcite: 350-2300nm



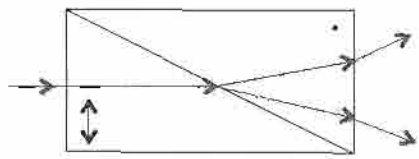
Quartz: 200-2300 nm

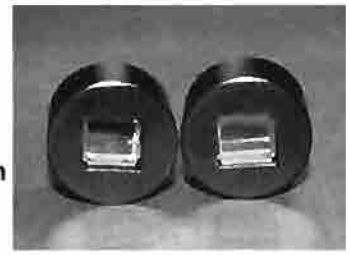


YVO_4:400-4000nm



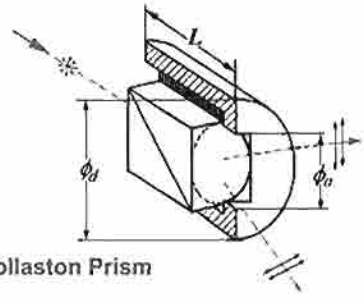
MgF2:200-4000 nm





Specifications:

Material	:	α-BBO, Calcite, YVO4, Quartz
Wavelength Range	:	**α-BBO:** 200-3500 nm, **Calcite:** 350-2300 nm YVO4: 400-5000 nm, Quartz: 200-2300 nm MgF2:130-6000 nm
Extinction Ratio	:	**Calcite, Quartz:**<5×10^{-6} ; **α-BBO, YVO4, MgF_2:** <5×10^{-6}
Surface quality	:	20-10
Flatness	:	λ/4@633nm
Damage Threshold	:	>500 MW/cm²
Coating	:	Single Layer MgF_2
Mount	:	Black Anodized Alum



Wollaston Prism

WSP Separation Angle

	WSP5000	WSP6000	WSP7000	WSP8000	WSP9000
	MgF_2	α-BBO	Calcite	YVO4	Quartz
130	2.80				
150	3.24				
170	3.19				
190	3.11	27.18			
200	3.07	25.00			2.93
266	2.89	19.39			2.47
355	2.78	17.45	22.39		2.23
400	2.75	17.01	21.54	26.33	2.18
532	2.70	16.38	20.28	22.93	2.08
633	2.68	16.17	19.80	21.87	2.05
800	2.66	16.00	19.35	20.99	2.02
808	2.66	15.99	19.34	20.96	2.02
980	2.64	15.93	19.02	20.53	2.00
1064	2.64	15.91	18.88	20.40	2.00
1319	2.62	15.92	18.50	20.14	1.99
1550	2.60	15.96	18.14	20.00	1.99
2000	2.56	16.10	17.36	19.86	2.00
2500	2.50	16.33	16.30	19.77	2.00
3000	2.43	16.63		19.71	
4000	2.25	17.44		19.62	
5000	2.01	18.56		19.54	
6000	1.70				

1. α-BBO Wollaston Polarizer

P/N #		Extinction Ratio	Separation Angle (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
WSP6006	190-3500 (Single Layer MgF_2) (Coating@800nm)	<5 x 10^{-6}	15°-27° 16°@800nm	5.0	15.0	9.0	$259.0
WSP6008				7.0	25.4	11.0	$336.0
WSP6010				9.0	25.4	13.0	$439.0
WSP6015				13.5	30.0	18.0	$649.0
WSP6020				18.0	38.0	24.0	$959.0

Note: Price list is for quantity <=5 pcs.

Call for OEM quantity pricing, AR coated and Custom Design Polarizer.

2. Calcite Wollaston Polarizer

P/N #		Extinction Ratio	Separation Angle (deg)	CAΦa (mm)	O.DΦd (mm)	L+/-0.1 (mm)	Unit Price
WSP7006	350-2300 (Single Layer MgF_2) (Coating@980nm)	<5 x 10^{-5}	16.7°-22.5° 19°@980nm	5.0	15.0	9.0	$169.0
WSP7008				7.0	25.4	11.0	$218.0
WSP7010				9.0	25.4	13.0	$266.0
WSP7015				13.5	30.0	18.0	$419.0
WSP7020				18.0	38.0	24.0	$739.0

3. YVO_4 Wollaston Polarizer

P/N #		Extinction Ratio	Separation Angle (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
WSP8006	400~4000 (Single Layer MgF_2) (Coating@1550nm)	<5 x 10^{-6}	19.6°-23.3° 20°@1550nm	5.0	15.0	8.0	$219.0
WSP8008				7.0	25.4	10.0	$259.0
WSP8010				9.0	25.4	12.0	$349.0
WSP8015				13.5	30.0	16.0	$489.0
WSP8020				18.0	38.0	21.0	$859.0

4. Quartz Wollaston Polarizer

P/N #	Wavelength Range(nm)	Extinction Ratio	Separation Angle (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
WSP9006	200~2300 (Single Layer MgF_2) (Coating@1064nm)	<5 x 10^{-5}	2°-3° 2°@1064nm	5.0	15.0	14.0	$149.0
WSP9008				7.0	25.4	18.0	$199.0
WSP9010				9.0	25.4	22.0	$249.0
WSP9015				13.5	30.0	32.0	$359.0
WSP9020				18.0	38.0	44.0	$539.0

5. MgF_2 Wollaston Polarizer

P/N #		Extinction Ratio	Separation Angle (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
WSP5006	130~6000 Design: 532nm	<5 x 10^{-6}	2.7° @532nm	5.0	15.0	14.0	$379.0
WSP5008				7.0	25.4	18.0	$479.0
WSP5010				9.0	25.4	22.0	$579.0
WSP5015				13.5	30.0	32.0	$779.0
WSP5020				18.0	38.0	44.0	$1099.0

Note: Price list is for quantity <=5 pcs.

Call for OEM quantity pricing, AR coated and Custom Design Polarizer.

A wide variety of custom design Wollaston Polarizer are available upon request

Custom Designed Separation Angle at Certain Wavelength is available upon request

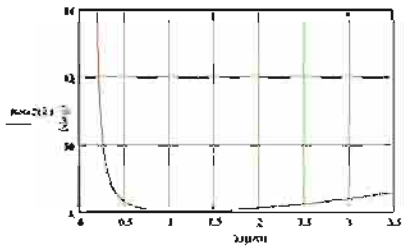
Custom-size Mounter is available upon request.

AR coated Polarizer is available upon request

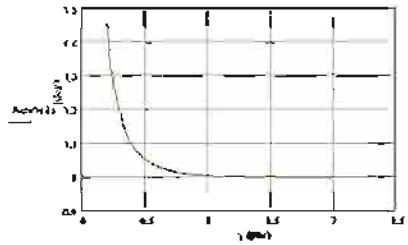
Rochon Polarizer

Rochon polarizer is one of the earliest designs, which is made of two birefringent material prisms cemented together. Both ordinary and extraordinary beams propagate collinearly down the optic axis in the first prism under the ordinary refractive index. Upon entering the second prism the ordinary beam experiences the same refractive index and continues undeviated. The extra-ordinary beam, however, now has a lower refractive index and is refracted at the interface. The angle of refraction is further increased at the birefringent material/air exit surface. Any separation angle can be designed for specific wavelength upon the requirement. The separation angle of standard products vs wavelength is shown in the plot below.

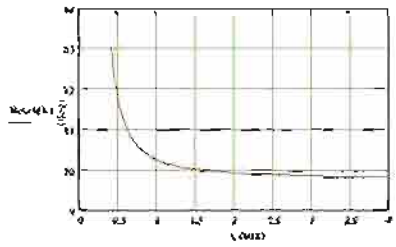
Separation Angle of Standard Products vs wavelength



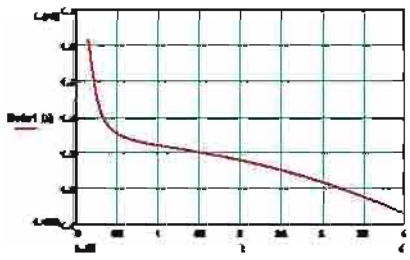
α-BBO: 190-3500 nm



Calcite: 350-2500 nm



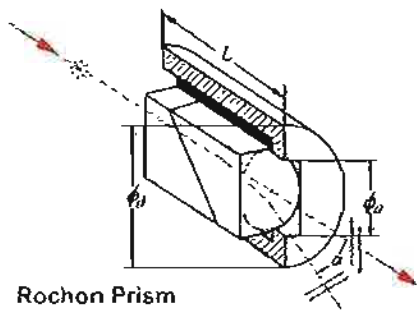
YVO_4: 400-4000 nm



MgF_2: 200-4000 nm

Specifications:

Material	:	α-BBO, MgF_2, YVO_4, Quartz
Wavelength Range	:	α-BBO: 190-3500 nm **MgF_2**: 130-6000 nm **YVO_4**: 400-4000 nm, **Quartz**: 200-2300 nm
Extinction Ratio	:	**Quartz**: $<5\times10^{-6}$; α-BBO, **YVO_4**, **MgF_2**: $<5\times10^{-6}$
Surface quality	:	20-10
Beam Deviation	:	< 3 arc minutes
Flatness	:	λ/4@633nm
Damage Threshold	:	>500 MW/cm²
Coating	:	Single Layer MgF_2
Mount	:	Black Anodized Alum



Rochon Prism

RCP Separation Angle

	RCP5000	RCP6000	RCP8000	RCP9000
	MgF_2	α-BBO	YVO4	Quartz
130	1.40			
150	1.62			
170	1.59			
190	1.55	13.93		
200	1.53	12.78		1.46
266	1.44	9.82		1.23
355	1.39	8.80		1.12
400	1.37	8.58	13.09	1.09
532	1.35	8.25	11.45	1.04
633	1.34	8.14	10.93	1.03
808	1.33	8.05	10.50	1.01
980	1.32	8.02	10.29	1.00
1064	1.32	8.00	10.22	1.00
1319	1.31	8.01	10.09	1.00
1550	1.30	8.03	10.03	1.00
2000	1.28	8.11	9.96	1.00
2500	1.25	8.23	9.91	
3000	1.22	8.39	9.88	
4000	1.13	8.83	9.83	
5000	1.01	9.43	9.79	
6000	0.85			

1. α-BBO Rochon Polarizer

P/N #	Wavelength Range(nm)	Extinction Ratio	Separation Angle (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
RCP6006	190~3500 (Single Layer MgF_2) (Coating@800nm)	<5 x 10^{-6}	8.0°-14° 8. 05°@800nm	5.0	15.0	8.0	$299.0
RCP6008				7.0	25.4	11.0	$369.0
RCP6010				9.0	25.4	13.0	$499.0
RCP6015				13.5	30.0	18.0	$699.0
RCP6020				18.0	38.0	22.0	$999.0

Note: Price list is for quantity <=5 pcs.

Call for OEM quantity pricing, AR coated and Custom Design Polarizer.

2. Quartz Rochon Polarizer

P/N #	Wavelength Range(nm)	Extinction Ratio	Beam Deviation Angle (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
RCP9006	200~2300 (Single Layer MgF_2) (Coating@1064nm)	<4 x 10^{-5}	1.0°-1.5° 1°@1064nm	5.0	15.0	16.0	$199.0
RCP9008				7.0	25.4	20.0	$259.0
RCP9010				9.0	25.4	25.0	$339.0
RCP9015				13.5	30.0	35.0	$449.0
RCP9020				18.0	38.0	45.0	$599.0

3. YVO_4 Rochon Polarizer

P/N #	Wavelength Range(nm)	Extinction Ratio	Separation Angle (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
RCP8006	400~4000 (Single Layer MgF_2) (Coating@1550nm)	<5 x 10^{-6}	9.8°-13.0° 10°@1550nm	5.0	15.0	8.0	$249.0
RCP8008				7.0	25.4	11.0	$329.0
RCP8010				9.0	25.4	13.0	$419.0
RCP8015				13.5	30.0	18.0	$559.0
RCP8020				18.0	38.0	22.0	$889.0

4. MgF2 Rochon Polarizer

P/N #	Wavelength Range(nm)	Extinction Ratio	Separation Angle (deg)	CA Φa (mm)	O.D. Φd (mm)	L+/-0.1 (mm)	Unit Price
RCP5006	130~6000 (Uncoating)	<5 x 10^{-5}	1.35°@532nm	5.0	15.0	16.0	$229.0
RCP5008				7.0	25.4	20.0	$309.0
RCP5010				9.0	25.4	25.0	$399.0
RCP5015				13.5	30.0	35.0	$559.0
RCP5020				18.0	38.0	45.0	$879.0

Note: Price list is for quantity <=5 pcs.

Call for OEM quantity pricing, AR coated and Custom Design Polarizer.

A wide variety of custom design Rochon Polarizer are available upon request.

Custom Designed Separation Angle at Certain Wavelength is available upon request.

Custom-size Mounter is available upon request.

AR coated Polarizer is available upon request.

Broadband Polarization Beam Combiner

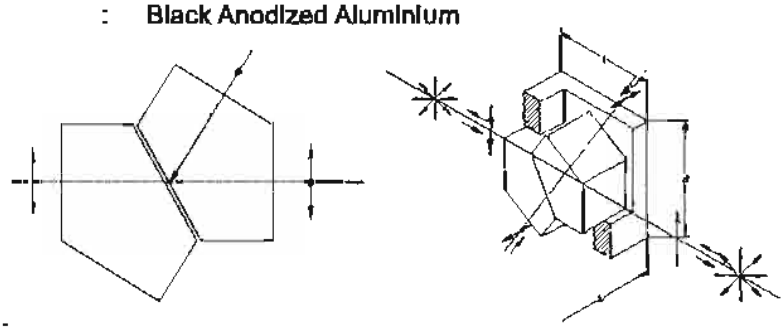
The Polarization Beam Combiner is made of two pieces YVO_4 Prism or Calcite Prism. The Calcite Polarization combiner can be with 45° or 90° of two polarization Beam Input. Please refer to Glan Thompson Beamsplitter Cube (Page 53), The Glan Thomposn Beamsplitter made of calcite can also work as polarization Beam combiner. But since it is glue cemented, the damage threshold is lower. While we specially design the air spaced Polarization Beam combiner, which is made of YVO_4. The Angle between two input polarization beam is 100.6 deg. All the input & output surfaces are optical polished and coated.

Features:

- Air Spaced.
- High Damaged threshold.
- Broad Band for 400-5000 nm.

Specifications:

Material	:	YVO_4
Wavelength Range	:	400-5000 nm,
Surface quality	:	40/20
Beam Deviation	:	< 3 arc minutes
Flatness	:	λ/4@633nm
Damage Threshold	:	>500 MW/cm²
Coating	:	Single lager MgF_2@ 1064 nm
Mount	:	Black Anodized Aluminium



Standard Products:

P/N #	Wavelength Range (nm)	CA Φa (mm)	W+/-0.1 (mm)	H+/-0.1 (mm)	L+/-0.1 (mm)	Unit Price
PBC8008	400-5000 (Single Layer MgF_2) (Coating@1550nm)	5.0	15.0	15.0	15.0	$389.0
PBC8008		7.0	16.0	20.0	18.0	$499.0
PBC8010		9.0	20.0	25.0	22.0	$599.0
PBC8012		11.0	20.0	30.0	25.0	$699.0
PBC8015		13.5	25.0	35.0	30.0	$829.0

Note: Price list is for quantity <5= pcs.

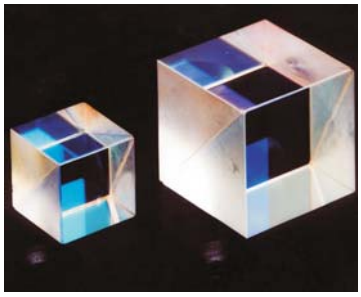
Call for OEM quantity pricing, AR coated and Custom Design Polarizer.

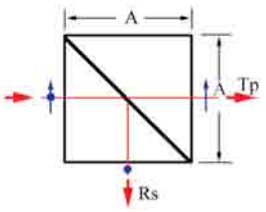
Polarization Beamsplitter Cube

Polarization Beamsplitters Cube split randomly polarized beams into two orthogonal, linearly, polarized components-S-polarized light is reflected at a 90deg. Angle while P-polarized light is transmitted. Each beamsplitter consists of a pair of precision high tolerance right angle prisms cemented together with a dielectric coating on the hypotenuse of one of prisms.

Specification

Dimension Tolerance:----------±0.2mm
Flatness: ----------λ/4@632.8nm
Surface Quality: ----------60-40 scratch and dig
Beam Deviation: ----------<3 arc minutes
Extinction Ratio: ----------->100:1
Principal Transmittance: ----------Tp>95% and Ts<1% *
Principal Reflectance: ----------Rs>99% and Rp<5%
Coating: Hypotenuse Face: ----------Polarization Beamsplitter Coating
All Input and Output Faces: ----------AR Coating
* Principal Transmittance for 450~680nm: ----------Tp_avg>95% (Broadband)

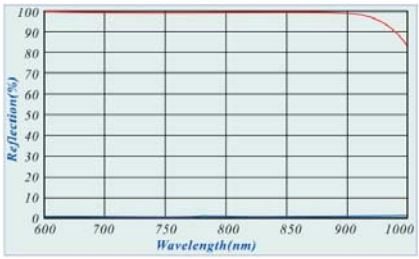




Narrowband

Material: ---------- N-BK7 or H-K9L Grade A optical glass
Standard wavelength: ---------- 488, 532, 633, 850, 980, 1064, 1310, 1550 nm

Size(mm)	Part No.	Unit Price
3.2x3.2x3.2	PBS1101	$49.0
5x5x5	PBS1102	$49.0
10x10x10	PBS1103	$49.0
12.7x12.7x12.7	PBS1104	$49.0
15x15x15	PBS1105	$59.0
20x20x20	PBS1106	$69.0
25.4x25.4x25.4	PBS1107	$79.0

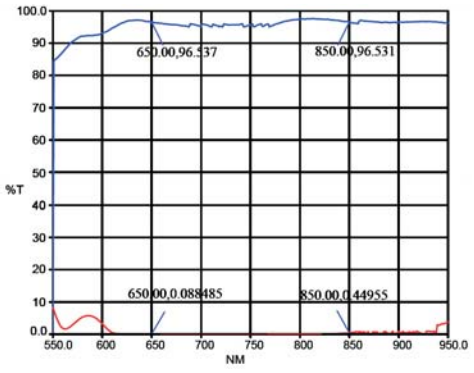


Rs>99%,Rp<5% @650-850nm

Broadband

Material: ----------$N\text{-}SF_2$ or $H\text{-}ZF_1$ optical glass
* Material for PBS(450-680nm) is H-ZF2（N-SF5）
Coating wavelength: 450-680, 650-850, 900-1200, 1250-1570, 1500-1610 nm

Size(mm)	Part No.	Unit Price
3.2x3.2x3.2	PBS5201	$59.0
5x5x5	PBS5202	$59.0
10x10x10	PBS5203	$59.0
12.7x12.7x12.7	PBS5204	$59.0
15x15x15	PBS5205	$69.0
20x20x20	PBS5206	$79.0
25.4x25.4x25.4	PBS5207	$89.0



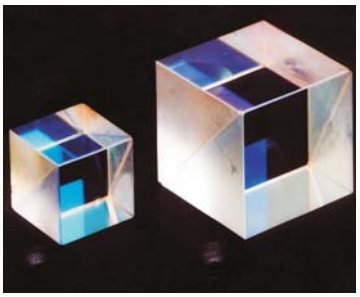
Tp>95%, Ts<1% @650-850nm

Ordering Information

Part No. - Wavelength
For Example, PBS5201 - 1500-1610nm
Polarization Beamsplitter Cube 3.2x3.2x3.2mm, 1500-1610nm broadband coating

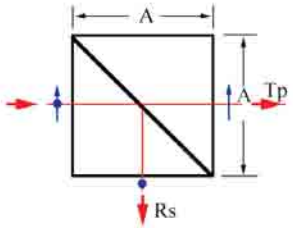
High Extinction Polarization Cube BeamSplitter

Tp : Ts > 1000:1 for Broad band
Tp : Ts > 3000:1 for Narrow band



Specification

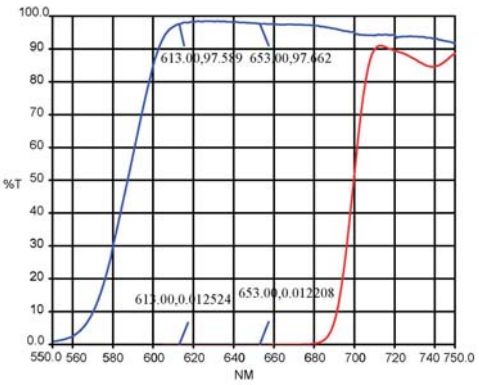
Dimension Tolerance: ---------- ±0.2mm
Flatness: ---------- λ/4@632.8nm
Surface Quality: ---------- 60-40 scratch and dig
Beam Deviation:---------- <3 arc minutes
Extinction Ratio:---------- Tp : Ts > 1000:1 for Broadband
Tp : Ts > 3000:1 for Narrowband
Principal Transmittance: ---------- Tp>90% for Broadband*
Tp>96% for Narrowband
Principal Reflectance: ---------- Rs>99.5%
Coating: Hypotenuse Face: ---------- Polarization Beamsplitter Coating
All Input and Output Faces: ---------- AR Coating
* Principal Transmittance for 450~680nm: ---------- Tp_avg>90% (Broadband)



Narrowband

Material: ---------- N-BK7 or H-K9L Grade A optical glass
Standard wavelength: ---------- 532, 633, 980, 1064 nm (other wavelength is available upon request)

Size(mm)	Part No.	Unit Price
3.2x3.2x3.2	PBS1301	$69.0
5x5x5	PBS1302	$69.0
10x10x10	PBS1303	$89.0
12.7x12.7x12.7	PBS1304	$99.0
15x15x15	PBS1305	$119.0
20x20x20	PBS1306	$139.0
25.4x25.4x25.4	PBS1307	$149.0



PBS@633 20nm,Tp>96%,Tp:Ts>3000:1

Broadband

Material: ---------- N-SF2 or H-ZF1 optical glass
* Material for PBS(450-650nm) is H-ZF2（N-SF5）
Coating wavelength: 450-650, 650-850, 900-1200 nm (other wavelength is available upon request)

Size(mm)	Part No.	Unit Price
3.2x3.2x3.2	PBS5301	$89.0
5x5x5	PBS5302	$89.0
10x10x10	PBS5303	$119.0
12.7x12.7x12.7	PBS5304	$129.0
15x15x15	PBS5305	$149.0
20x20x20	PBS5306	$159.0
25.4x25.4x25.4	PBS5307	$169.0

Ordering Information

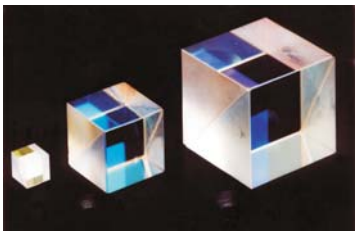
Part No. - Wavelength
For Example, PBS5301 - 900-1200nm
High Extinction PBS 3.2x3.2x3.2mm, 900-1200nm broadband coating

High Power Polarization Cube BeamSplitter

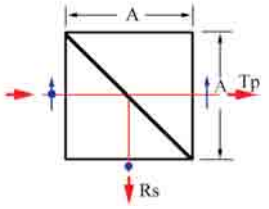
High Power PBS

High Damage Threshold: ----------10J/cm2@1064nm 20ns, 20Hz for Narrowband
10J/cm2@1064nm 20ns, 20Hz for Broadband

Specification



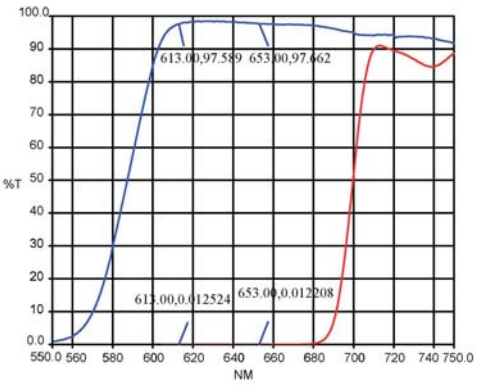
Dimension Tolerance: ---------- 0.2mm
Flatness: ----------λ/4@632.8nm
Surface Quality: ---------- 60-40 scratch and dig
Beam Deviation: ----------<3 arc minutes
Extinction Ratio: ----------TP : TS > 1000:1
Principal Transmittance: ---------- Tp>90% for Broadband *
Tp>95% for Narrowband
Principal Reflectance: ----------Rs>99.5%
Coating: Hypotenuse Face: ---------- Polarization Beamsplitter Coating
All Input and Output Faces: ----------AR Coating
* Principal Transmittance for 450~680nm: -------Tp_avg>90% (Broadband)



Narrowband

Material: ---------- N-BK7 or H-K9L Grade A optical glass
Standard wavelength: ---------- 532, 633, 1064 nm (other wavelength is available upon request)

Size(mm)	Part No.	Unit Price
3.2x3.2x3.2	PBS1401	$85
5x5x5	PBS1402	$85
10x10x10	PBS1403	$160
12.7x12.7x12.7	PBS1404	$200
15x15x15	PBS1405	$280



PBS@633 20nm,Tp>96%,Tp:Ts>3000:1

Broadband

Material: ---------- N-SF2 or H-ZF1 optical glass
* Material for PBS(450-650nm) is H-ZF2（N-SF5）
Coating wavelength: 450-650, 650-850, 900-1200 nm (other wavelength is available upon request)

Size(mm)	Part No.	Unit Price
3.2x3.2x3.2	PBS5401	$95
5x5x5	PBS5402	$95
10x10x10	PBS5403	$180
12.7x12.7x12.7	PBS5404	$220
15x15x15	PBS5405	$300

Ordering Information

Part No. - Wavelength
For Example, PBS1401 - 1064nm, It is for High Power PBS 5x5x5mm, 1064nm narrowband coating

Depolarizer

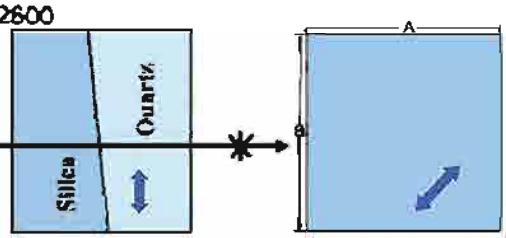
There is often circumstance when a plane-polarized beam can be undesirable, as for instance, with a polarization sensitive instrument such as a reflecting spectrometer. A depolarizer will change this beam into a pseudo-depolarized beam by scrambling up the polarization

Quartz Silica Wedge Depolarizer

This DQW series of depolarizer consists of a crystalline quartz wedge together with a compensating fused silica wedge to correct the angular deviation. The optic axis of the quartz wedge lies in the plane of the wedge and at 45 deg to the input polarization. The result is then a variable retardation plate over the aperture, which produces depolarization for all wavelengths. So, this DQW depolarizer is thus effective with monochromatic light.

Standard Specifications:

Spectral rang (nm): ——— 220-1100, 1100-2600
Diamter tolerance: ——— +0.0/-0.2 mm
Surface Quality: ——— 60/40
Flatness @ 632.8nm: ——— λ/8
Parallelism: ——— <1 min
Chip: ——— <0.2 mm
Chamfer (bevel): ——— <0.5 mm x 45 deg
Peak transmission (%): ——— 92 (Uncoated)
Coating: ——— uncoated
Mountter: ——— unmounted
Max peak power (MW/cm2): ——— 300
Max cw power (W/cm2): ——— 100



Quartz –Silica Wedge Depolarizer

Coating: MgF_2, Narrow Band or Broad Band AR coating is available.

Mountter: Black anodized aluminum ring is available. To order mounted depolarizers, simply add the Suffix M to the part no.

P/N#	Size (mm) A = B	CA Φa (mm)	Thickness (mm)
DQW10	10.0	9.0	5
DQW12	12.7	11.5	5
DQW15	15.0	13.5	5
DQW20	20.0	18.5	5
DQW25	25.4	22.0	5

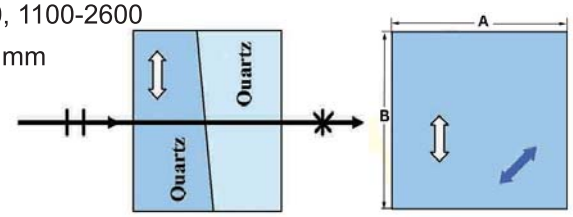
Advanced Quartz Lyot Depolarizer

This DAQ series of depolarizers is an improved Quartz Lyot Depolarizer, which consists of two quartz crystal wedges with their optic axes lying in the plane of the plates, and aligned at 45° with each other. It has the advantages of both Lyot and Wedge Depolarizer. One plate of the two quartz wedge is exactly twice the thickness of the other. The result is then a variable retardation plate over the aperture, which produces depolarization for all wavelengths. By this specially designed structure, we can get much better depolarization result than DQL and DQW type.

This DAQ depolarizer is also effective with monochromatic light.

Standard Specifications:

Spectral rang (nm): ---------- 220-1100, 1100-2600
Diamter tolerance: ---------- +0.0/-0.2 mm
Surface Quality: ---------- 60/40
Flatness @ 632.8nm: ---------- λ/8
Parallelism: ---------- <1 min
Beam deviation: ---------- <3 min
Chip: ---------- <0.2 mm
Chamfer (bevel): ---------- <0.5 mm x 45 deg
Peak transmission (%): ---------- 92 (Uncoated)
Coating: ---------- uncoated
Mountter: ---------- unmounted
Max peak power (MW/cm2): ---------- 300
Max cw power (W/cm2): ---------- 100



Advanced Quartz Lyot Depolarizer

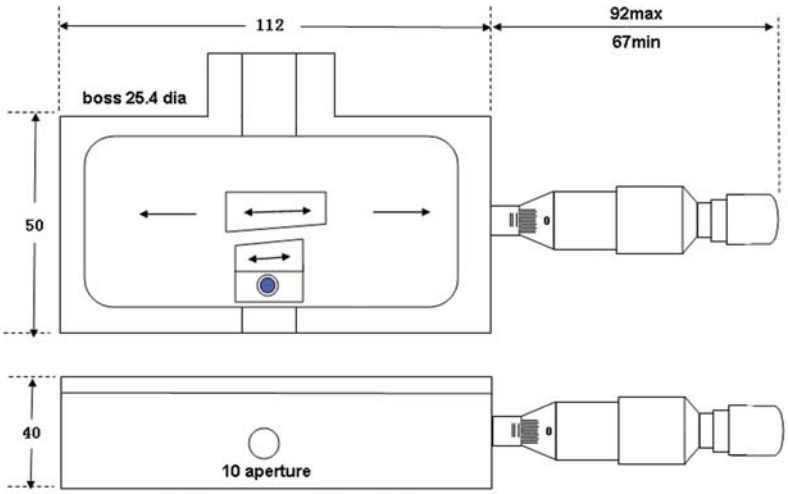
Coating: MgF_2, Narrow Band or Broad Band AR coating is available.

Mounter: Black anodized aluminum ring is available. To order mounted depolarizers, simply add the Suffix M to the part no.

P/N#	Size (mm) A = B	CA Φa (mm)	Thickness (mm)
DAQ10	10.0	9.0	12.15
DAQ12	12.7	11.5	12.15
DAQ15	15.0	13.5	12.15
DAQ20	20.0	18.5	12.15
DAQ25	25.4	22.0	12.15

Babinet Compensator

This precision optical instrument is invaluable for the complete analysis of polarized light. There are two models available-Model BSC 100 fabricated from synthetic crystal quartz which spans from 190-1600nm and Model BSC 100F in magnesium fluoride which covers from 120nm-7.5μm.



Theory

The BSC 100 Babinet Soleil Compensator is constructed from two opposed crystal quartz wedges with a compensating quartz block in optical contact with the smaller wedge as shown below.

Both wedges are cut with the quartz optic axis parallel to their long edges, and the compensating block has its axis at right angles. In operation, the large wedge is translated across the smaller, thus presenting a variable path length difference to an optical beam passing through the instrument. The compensating block ensures that this difference is uniform across the aperture.

The Compensator is aligned so that its axis lies at 45° to the polarization direction of the input beam. This beam can be considered to be resolved into two components lying parallel to the quartz fast and slow (optic) axes. On emerging from the Compensator, each component now has a differential phase retardation dependent upon the optical path length difference through the quartz. Adjusting this path length difference by translating the large wedge varies the retardation in direct proportion.

The wedge angle is calculated such that full scale movement (up or down) from centre zero introduces a half wave retardation (plus or minus) at the logest design wavelength (1600nm for model BSC100 or 7.5μm for Model BSC 100F). Because the retardation scales inversely with wavelength for a given path difference, operation at shorter wavelengths results in a full scale translation producing more than one half wave retardation. For the BSC100 at 100nm, there are approximately 2.75 half waves per full scale.

Model BSC100

This Compensator, using synthetic crystal quartz elements, is designed for use over the wavelength range 190-1600nm, covering the most popular laser wavelengths from Nd:YAG 4th harmonic @ 266nm to GaInAsP @ 1550nm. The Compensator is factory preset for zero retardation at the micrometer range centre (0.500"), and we supply a calibration curve for the calculation of retardation vs micrometer setting at any wavelength within 300-1600nm. Note that the Compensator functions as a zero order retardation plate when used at micrometer settings between center zero (0.500") and the first half wave retardation setting (positive or negative).

Model BSC100F

This Compensator, using magnesium fluoride elements,is designedfor use over the wavelength range 120nm-7.5μm, covering the vacuum ultra violet through to the visible band. The Compensator is factory reset for zero retardation at the micrometer range center (0.500"), and we supply a calibration curve for the calculation of retardation va micrometer setting at any wavelength within 120nm-7.5μm.

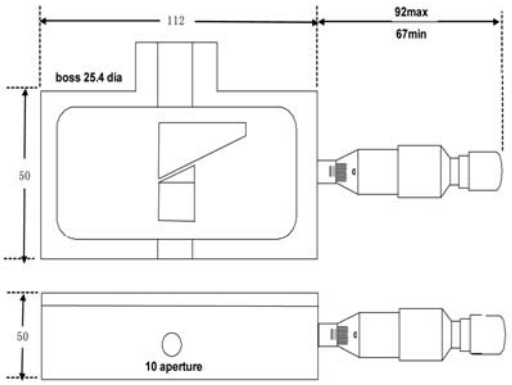
Specifications:

Aperture(mm): ——————————————————————10
BSC100 design range(nm): ——————————— 190-1600 (Quartz)
BSC100F design range(nm): ——————————— 120-7500(MgF_2)
Retardation range: ——————————————————— +/-180°
Calibration accuracy: ——————————————————— +/-1°
MOUNTING
All Compensators are fitted with a I "diameter boss to interface to any I" bore optical mount.

Variable Rotator

This useful instrument introduces a variable rotation between 0° and 90° to an input plane polarized beam. The rotation angle is controlled by a manually driven precision micrometer. Calibration scales are supplied to enable any desired rotation to be set for a given wavelength of operation.

Theory



The VR100 Variable Rotator is constructed from two left rotating opposed crystal quartz wedges with a compensating right-rotating crystal block in optical contact with the smaller wedge. Both wedges and the compensating block are cut with the optic axis parallel to the beam propagation direction. In operation, the large wedge is translated across the smaller, thus presenting a variable amount of left rotation to an optical beam passing through the Instrument. The compensating block introduces the exact opposite right rotation when the instrument is set at the zero position.

The input beam propagates through both wedges, and suffers a rotation of its plane of polarization proportional to the difference in thickness between the two combined wedges and the compensating

Model VR100

This rotator using natural optically active crystal quartz element is designed for use over the wavelength range 230nm-1100nm,covering the most popular laser wavelengths from Nd:YAG 4th harmonic @ 266nm to the fundamental @ 1064nm. The variable rotator is factory preset for zero rotation at the micrometer zero position, and we supply a calibration curve for the calculation of rotation vs micrometer setting at any wavelength within 230nm-1100nm.

Note that this variable rotator is completely linear:i.e.at a given wavelength, rotation scales in direct proportion to the micrometer reading.

Specifications:

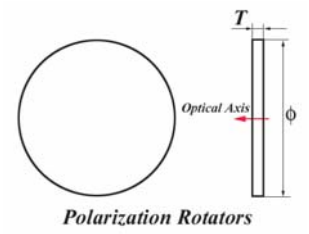
Aperture (mm): ---------- 10
Spectral Range (nm): ---------- 230-1100
Rotation range: ---------- 0°-90°
Calibration accuracy: ---------- +/-1°

Polarization Rotator

Polarization rotators offer 45° or 90° rotation at a number of common laser wavelength, the optical axis in a polarization rotator is perpendicular to the polished face of the optic. The result is that the orientation of input linearly polarized light is rotated as it propagates through the device.

Specifications:

Material	:	Optical Grade Crystal Quartz
Wavelength Range		440-1600 nm
Parallelism	:	<10 arc seconds
Diameter Tolerance	:	+0.0, -0.2
Surface Quality	:	20-10
Retardation Accuracy	:	< 5 minutes
Wavefront Distortion	:	λ/4@633nm
Clear Aperture	:	Central 90%
AR Coated	:	<0.2% @ central wavelength
Rotation Orientation	:	Counter-clockwise



Polarization Rotators

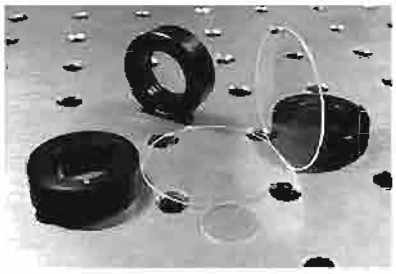
Standard Wavelength: 532nm, 632.8nm, 1064nm,

Rotator P/N#	Diameter (mm)	Rotation (Deg)	Price/pc in US$ for different pcs range			
			qty<=5	5<qty<=10	10<qty<=20	qty>20
WPR4512	12.7	45	$49	$41	$34	RFQ
WPR4515	15	45	$55	$46	$39	RFQ
WPR4520	20	45	$63	$53	$45	RFQ
WPR4525	25.4	45	$69	$59	$49	RFQ
WPR9012	12.7	90	$69	$59	$48	RFQ
WPR9015	15	90	$63	$53	$44	RFQ
WPR9020	20	90	$69	$59	$49	RFQ
WPR9025	25.4	90	$79	$69	$58	RFQ

Note: "RFQ" stands for "Request For Quoting".

Call for price of OEM quantity, Custom-made WPR.

Waveplate

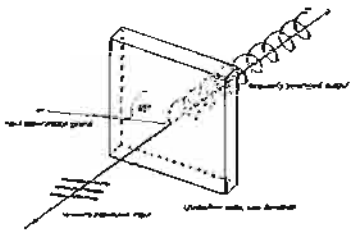


Waveplate is an optics in which the polished faces contain the optical axis. All light incidents normal to the surface are composed of components polarized parallel and perpendicular to the axis. In such a device, light polarized parallel to the axis will propagate slower than light polarized perpendicular to the axis. As the light propagates through the optic, the phase shift between the two components increases with thickness. The phase shift is called the retardance. The most popular retarders are quarter and half wave.

With an appropriate choice of thickness, any degree of retardance may be achieved at any wavelength for which quartz is transparent. However, the minimum thickness necessary to achieve a mechanically strong part corresponds to several full waves of retardance.

Quarter Waveplate

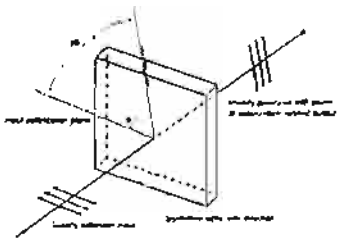
When linearly polarized light is input at 45deg to the axis of a quarter waveplate, the output is circularly polarized, similarly, input circularly polarized light is transformed into linearly polarized light.



Quarter Waveplate

Half Waveplate

A half waveplate rotates linearly polarized light to any desired orientation. The rotation angle is twice the angle between the incident polarized light and optical axis.



Half Waveplate

Zero Order Waveplate

The zero order waveplate is designed to give a retardance of zero full waves, plus the desired fraction. Zero order waveplate shows better performance than multiple order waveplates, it has broad bandwidth and a lower sensitivity to temperature and wavelength changes. It should be considered for more critical applications.

Specifications:

Material	:	Quartz
Parallelism	:	<3 arc second(General), <1 arc second(High Precision)
Diameter Tolerance	:	+0.0, -0.2
Surface quality	:	20-10
Wavefront Distortion	:	λ/8@633nm
Clear aperture	:	Central 90%
AR Coated	:	<0.2% @ wavelength
Holder	:	See page 118 in Part 6
Retardation Tolerance	:	See below table

Wavelength Range(nm)	< 400	532-632.8	780-980	1064	>1310
Retardation Tolerance	<λ/100	<λ/200	<λ/300	<λ/400	<λ/500

Foctek provides standard waveplate wavelengths (nm) listed as below.

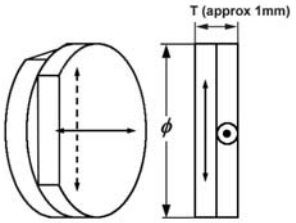
266	355	400	532	632.8	780	800	808	850	980	1064	1310	1480	1550

Note: Other wavelengths within the ranger of 200-2300nm are also available upon request.

Zero Order Waveplate - Cemented by Epoxy

This type of zero order waveplate is constructed of two multiple order waveplates with their axes crossed. Thus, the effect of the first plate is canceled by the second, except for the residual difference between them.

- Cemented by Epoxy
- AR Coated, R<0.2%
- Better Temperature Bandwidth
- Wide Wavelength Bandwidth

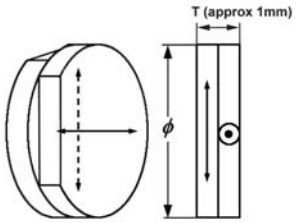


Quarter Waveplate P/N #	Half Waveplate P/N #	Diameter (mm)	Price/pc in US$ for different pcs range			
			qty<=5	5<qty<=10	10<qty<=20	qty>20
WPC210Q	WPC210H	10	$49	$39	$29	RFQ
WPC212Q	WPC212H	12.7	$55	$45	$35	RFQ
WPC215Q	WPC215H	15	$59	$49	$39	RFQ
WPC220Q	WPC220H	20	$69	$59	$49	RFQ
WPC225Q	WPC225H	25.4	$79	$69	$59	RFQ
WPC230Q	WPC230H	30	$99	$89	$65	RFQ

Note: "RFQ" stands for "Request For Quoting".

Zero Order Waveplate - Optically Contacted

- Optically Contacted
- AR Coated, R<0.2%
- High Damage Threshold
- Better Temperature Bandwidth
- Wide Wavelength Bandwidth

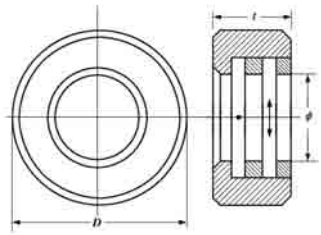


Quarter Waveplate P/N #	Half Waveplate P/N #	Diameter (mm)	Price/pc in US$ for different pcs range			
			qty<=5	5<qty<=10	10<qty<=20	qty>20
WPO210Q	WPO210H	10	$49.0	$39.0	$37.0-$27.0	RFQ
WPO212Q	WPO212H	12.7	$55.0	$45.0	$41.0-$30.0	RFQ
WPO215Q	WPO215H	15	$59.0	$49.0	$47.0-$35.0	RFQ
WPO220Q	WPO220H	20	$69.0	$59.0	$50.0-$39.0	RFQ
WPO225Q	WPO225H	25.4	$79.0	$69.0	$59.0	RFQ
WPO230Q	WPO230H	30	$99.0	$89.0	$65.0	RFQ

Note: “RFQ” stands for “Request For Quoting”.

Zero Order Waveplate - Air-spaced

- Double Retardation Plates
- AR Coated, R<0.2% and Mounted
- High Damage Threshold
- Broad Temperature Bandwidth
- Wide Wavelength Bandwidth



Mounter Thickness: t=8.0+/-0.1 mm

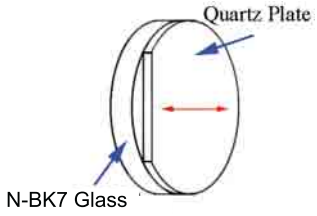
Quarter Waveplate P/N #	Half Waveplate P/N #	Mount Diameter (mm)	Aperture (mm)	Price/pc in US$ for different pcs range			
				qty<=5	5<qty<=10	10<qty<=20	qty>20
WPA210Q	WPA210H	25.4	10	$55.0	$49.0	$47.0-$35.0	RFQ
WPA212Q	WPA212H	25.4	12.7	$59.0	$52.0	$49.0-$39.0	RFQ
WPA215Q	WPA215H	25.4	15	$69.0	$59.0	$49.0	RFQ
WPA220Q	WPA220H	30	20	$89.0	$79.0	$69.0	RFQ
WPA225Q	WPA225H	30	23.5	$99.0	$89.0	$79.0	RFQ

Note: “RFQ” stands for “Request For Quoting”.

True Zero Order Waveplate - Cemented

This type of zero order waveplate is constructed of a true zero order waveplate and a N-BK7 substrate. As the waveplate is very thin and easy to be damaged, the N-BK7 plate's function is to strengthen the waveplate.

- Cemented by Epoxy
- Wide Angle Acceptance
- Better Temperature Bandwidth
- Wide Wavelength Bandwidth
- AR Coated, R<0.2%



Standard Wavelengh Applied: λ/4: 632.8nm, 780nm, 808nm, 850nm, 980nm, 1064nm, 1310nm, 1480nm, 1550nm
λ/2: 532nm, 632.8nm, 780nm, 808nm, 850nm, 980nm, 1064nm, 1310nm, 1480nm,

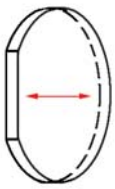
Quarter Waveplate P/N #	Half Waveplate P/N #	Diameter (mm)	Price/pc in US$ for different pcs range			
			qty<=5	5<qty<=10	10<qty<=20	qty>20
WPF210Q	WPF210H	10	$55.0	$49.0	$47.0-$35.0	RFQ
WPF212Q	WPF212H	12.7	$59.0	$52.0	$49.0-$39.0	RFQ
WPF215Q	WPF215H	15	$69.0	$59.0	$49.0	RFQ
WPF220Q	WPF220H	20	$89.0	$79.0	$69.0	RFQ
WPF225Q	WPF225H	25.4	$99.0	$89.0	$79.0	RFQ
WPF230Q	WPF230H	30	$179.0	$159.0	$149.0	RFQ

Note: "RFQ" stands for "Request For Quoting".

True Zero Order Waveplate - Single Plate

This type of zero order waveplate is designed for high damage threshold application (more than 1GW/cm^2). As the plate is very thin, it's easy to break during operation.

- Single Plate
- Wide Angle Acceptance
- Better Temperature Bandwidth
- Wide Wavelength Bandwidth
- High Damage Threshold
- Thin Thickness: 0.04~0.09 mm
- AR Coated, R<0.2%



Standard Wavelengh Applied: λ/4: 1480nm, 1550nm
λ/2: 980nm, 1064nm, 1310nm, 1480nm, 1550nm

Quarter Waveplate P/N #	Half Waveplate P/N #	Diameter (mm)	Price/pc in US$ for different pcs range			
			qty<=5	5<qty<=10	10<qty<=20	qty>20
WPS210Q	WPS210H	10	$55.0	$49.0	$47.0-$35.0	RFQ
WPS212Q	WPS212H	12.7	$59.0	$52.0	$49.0-$39.0	RFQ
WPS215Q	WPS215H	15	$69.0	$59.0	$49.0	RFQ
WPS220Q	WPS220H	20	$89.0	$79.0	$69.0	RFQ

Note: "RFQ" stands for "Request For Quoting".

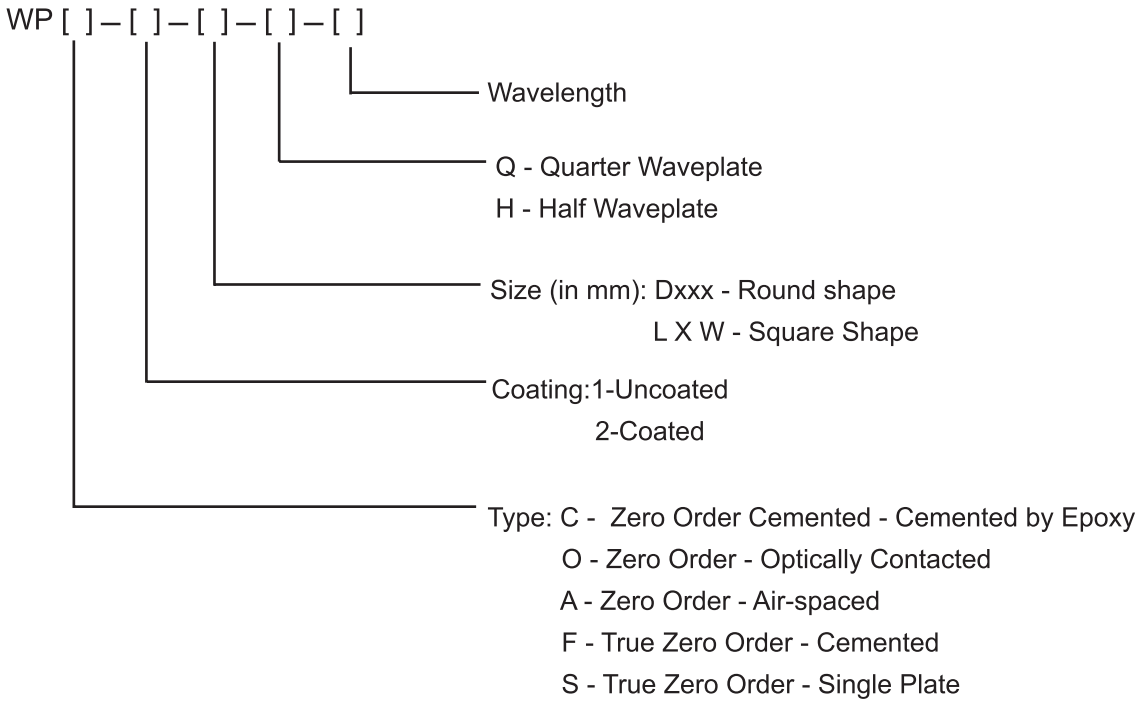
Ordering information

1. Standard Size Products listed in above table

P/N # - Wavelength

Example: WPS210Q-1550 Single plate quarter waveplate, diameter 10 mm, wavelength 1550 nm

2. Non-Standard Size Products



Example: WPF 2- D17.5 - Q - 632.8

True Zero Order - Cemented , Dia 17.5 mm, Quarter, 632.8 nm Waveplate, Coated

WPC 1- 15 X 10 - H - 808

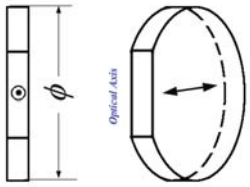
Zero Order - Cemented by Epoxy, 15 x 10 mm, Half, 808 nm Waveplate, Uncoated

Low Order (Multi-Order) Waveplate

The low (multiple) order waveplate is designed to give a retardance of several full waves, plus the desired fraction. This result in a single, physically robust component with desired performance. However, even small changed in wavelength or temperature will result in significant changes in the desired fractional retardance. They are less expensive and widely used in many applications where the increased sensitivities are not an important.

Specifications:

Material	:	Quartz
Parallelism	:	<3 arc second(General), <1 arc second(High Precision)
Diameter Tolerance	:	+0.0, -0.2
Surface quality	:	20-10
Wavefornt Distortion	:	λ/8@633nm
Clear aperture	:	Central 90%
AR Coated	:	<0.2% @ wavelength
Holder	:	See page 118 in Part 6
Retardation Tolerance	:	See below table



Wavelength Range(nm)	< 400	532-632.8	780-980	1064	>1310
Retardation Tolerance	<λ/100	<λ/200	<λ/300	<λ/400	<λ/500

Standard wavelength: 266nm, 355nm, 400nm, 532nm, 632.8nm, 780nm, 800nm, 808nm, 850nm, 980nm, 1064nm, 1310nm, 1480nm, 1550nm

Quarter Waveplate P/N #	Half Waveplate P/N #	Diameter (mm)	Price/pc in US$ for different pcs range			
			qty<=5	5<qty<=10	10<qty<=20	qty>20
WPL210Q	WPL210H	10	$35.0	$29.0	$27.0-$17.0	RFQ
WPL212Q	WPL212H	12.7	$39.0	$33.0	$31.0-$21.0	RFQ
WPL215Q	WPL215H	15	$45.0	$39.0	$37.0-$27.0	RFQ
WPL220Q	WPL220H	20	$49.0	$42.0	$40.0-$30.0	RFQ
WPL225Q	WPL225H	25.4	$55.0	$49.0	$47.0-$35.0	RFQ
WPL230Q	WPL230H	30	$69.0	$59.0	$59.0	RFQ

Note: "RFQ" stands for "Request For Quoting".

Call for OEM quantity pricing.

A wide variety of custom low order waveplates are available, please contact us with your custom requirement.

Ordering information

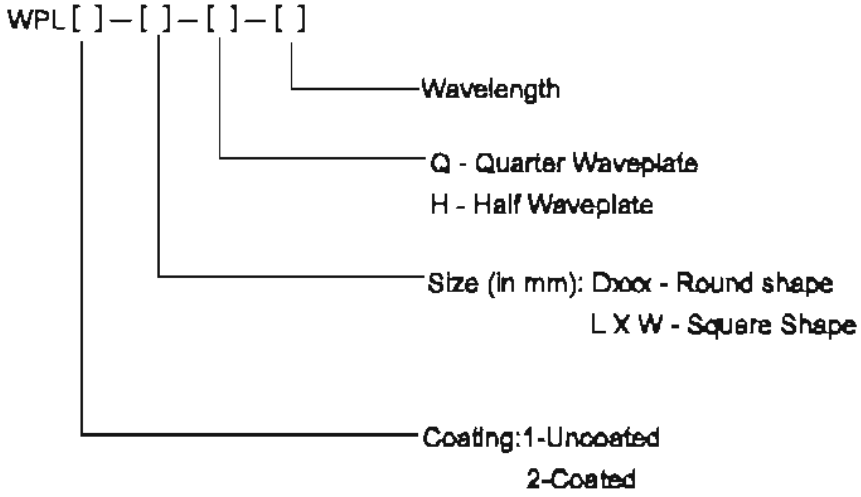
1. Standard Size Products listed in above table

P/N # - Wavelength

Example: WPL210Q-1064

Low order quarter waveplate, diameter 10 mm, wavelength 1064 nm

2. Non-Standard Size Products



Example: WPL 1- D17.5 - Q - 632.8

Low Order, Dia 17.5 mm, Quarter, 632.8 nm Waveplate, Uncoated

WPL 2 - 15 X 10 - H - 808

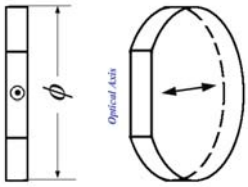
Low Order, 15 x 10 mm, Half, 808 nm Waveplate, coated

Dual Wavelengths Waveplate

Dual wavelength waveplate is a multiple waveplate that provide a specific retardance at two different wavelengths, it is particularly useful when used in conjunction with other polarization sensitive components to separate coaxial laser beams of different wavelength.

Specifications:

Material	:	Optical Grade Crystal Quartz
Parallelism	:	<3 arc second(General), <1 arc second(High Precision)
Diameter Tolerance	:	+0.0, -0.2
Surface quality	:	20-10
Retardation Tolerance	:	<λ/300
Wavefornt Distortion	:	λ/8@633nm
Clear aperture	:	Central 90%
AR Coated	:	<0.2% @ wavelength
Damage threshold		500MW/cm² in 5ns pulse
Holder	:	See page 118 in PART 6



Wavplates P/N#	Diameter (mm)	Phase Retardation	Price/pc in US$ for different pcs range			
			qty<=5	5<qty<=10	10<qty<=20	qty>20
WPD2121	12.7	λ@1064nm+λ/2@532nm	$56	$46	$35	RFQ
WPD2122	12.7	λ/2@1064nm+λ@532nm	$56	$46	$35	RFQ
WPD2151	15	λ@1064nm+λ/2@532nm	$63	$53	$42	RFQ
WPD2152	15	λ/2@1064nm+λ@532nm	$63	$53	$42	RFQ
WPD2201	20	λ@1064nm+λ/2@532nm	$69	$59	$49	RFQ
WPD2202	20	λ/2@1064nm+λ@532nm	$69	$59	$49	RFQ
WPD2251	25.4	λ@1064nm+λ/2@532nm	$84	$69	RFQ	RFQ
WPD2252	25.4	λ/2@1064nm+λ@532nm	$84	$69	RFQ	RFQ

Note: "RFQ" stands for "Request For Quoting".

Call for OEM quantity pricing.

Ordering Information for Non-Standard Dual wavelength Waveplates

WPD [ ] – [ ] – [ ] @ [ ] + [ ] @ [ ]

- Wavelength
- λ , λ /2 or λ /4
- Wavelength
- λ , λ /2 or λ /4
- Size (in mm): Dxxx - Round shape
  L X W - Square Shape
- Coating: 1-Uncoated
  2-Coated

Example: WPD 2-D16 - λ/2@1064+λ/4@532

Achromatic Waveplate

Unlike standard waveplates, Achromatic Waveplates, AWP, provide a constant phase shift independent of the wavelength of light that is used. This wavelength independence is achieved by using two different crystalline materials to yield quarter- or half-wave retardation over a broad spectral range. The Retardation tolerance of our AWPs is better than λ /100 over the entire wavelength range. The flat response of an AWP is ideal for use with tunable lasers, multiple laser-line systems and other broad spectrum sources.

Foctek's AWPs are designed to effectively eliminate the wavelength dependence over a wide spectral range, typically several hundred nanometers. Our AWPs are available for four wavelength ranges: VIS (450-680nm), NIR (700-1000nm), 950-1300, 1200-1650. The AWPs are air spaced construction in a black anodized aluminum housing. Fast axis is marked on the mount. Custom assemblies, including cemented versions, are available to meet your specific requirements.

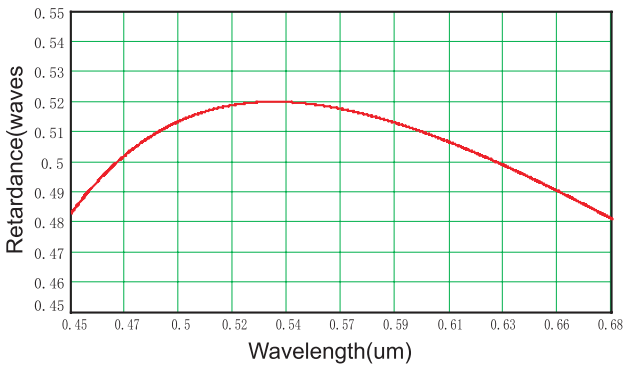
Specifications:

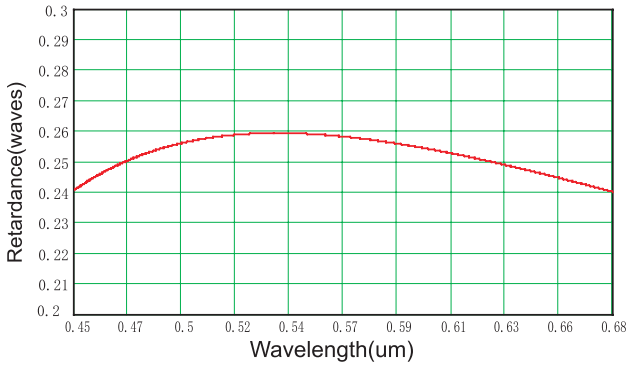
Material	:	Crystal Quartz & MgF_2
Parallelism	:	< 3 arc second
Diameter Tolerance	:	+0.0, -0.2
Surface quality	:	40/20 scratch dig
Retardation	:	λ/2 and λ/4
Retardation Tolerance	:	<λ/100 over wavelength range
Wavefornt Distortion	:	λ/4@633nm
AR Coated	:	Rave<0.8%@450-680 Rave<0.8%@700-1000 Rave<0.5%@950-1300 Rave<0.5%@1200-1650

Wavelength Ranges: 450～680nm, 700～1000nm, 950～1300nm, 1200～1650nm

Quarter Waveplates P/N #	Half Waveplates P/N #	Mounter Diameter (mm)	Clear Aperture (mm)	Thickness (mm)	Unit Price
AWP 210Q	AWP 210H	25.4	10.0	8.0	$299
AWP 212Q	AWP 212H	25.4	12.7	8.0	$329
AWP 215Q	AWP 215H	25.4	15.0	8.0	$359
AWP 220Q	AWP 220H	30.0	20.0	8.0	$389
AWP 225Q	AWP 225H	30.0	23.5	8.0	$429

Achromatic Waveplate Curves





Please visit our web www.foctek.net for more curves of other Wavelength range

PART 4

CRYSTAL COMPONENTS

Nd:GdVO4

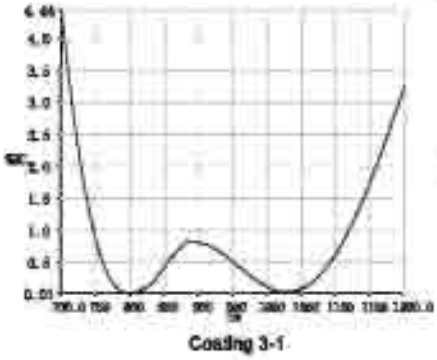
Neodymium doped Gadolinium Vanadate (Nd:GdVO4) is a promising material for diode pumped laser. Similar to Nd:YVO4 crystal, Nd:GdVO4 crystal also exhibits high gain, low threshold, and high absorption coefficients at pumping wavelengths, which result from the excellent fit of the neodymium dopant in the crystal lattice. Nd:GdVO4 has the additional advantage over Nd:YVO4 of a much higher thermal conductivity.
With advanced technology on growing and manufacturing high Laser quality Nd:GdVO4 crystals, FOCtek can provide a wide variety of finished crystals, our general Nd:GdVO4 production capabilities include.

Capabilities Include:

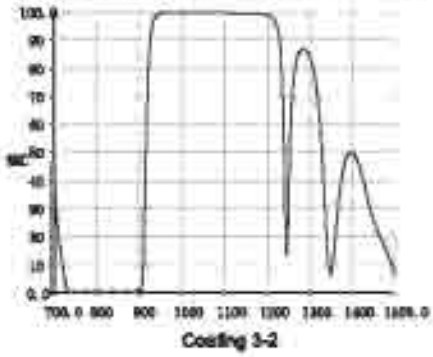
1) Nd dopant concentration:	0.2—3.0 atm%
2) Dopant tolerance:	within 10% of concentration.
3) Width×Height	1×1 ~16×16mm
4) Length:	0.02 ~ 20mm

Typical Specification and Tolerance:

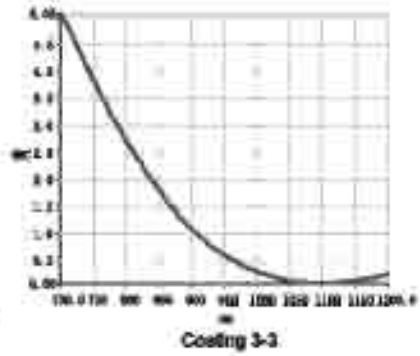
1) Orientation:	a-cut crystalline direction(+/-0.2°)
2) Dimensional tolerance:	+/-0.1mm(typical) High precision +/-0.005mm can be available upon request.
3) Wavefront Distortion:	<λ/8@633nm
4) Surface quality:	better than 20/10 Scratch/Dig per MIL-O-1380A
5) Parallelism:	< 10 arc seconds
6) Perpendicularity:	< 5 arc minutes
7) Surface flatness:	<λ/10 at 632.8nm
8) Clear aperture:	>Central 95%
9) Chamfer:	0.15mmx45°
10) Damage threshold:	over 15J/cm^3 (rods without coating) over 700 MW/cm^3 (coated)
11) Coating:	1)AR@1063nm, R< 0.1% & HT@808nm, T>95% (see coating 3-1) 2)HR@1063nm, R>99.8% & HT@808nm, T>95% (see coating 3-2) 3)AR@1063 nm, R<0.1% (see coating 3-3)



Coating 3-1



Coating 3-2



Coating 3-3

Notes:
To inquiry or order a finished Nd:$GdVO_4$ laser crystals, please specify the specification listed above, for common application, we only need to know the main specification: Nd-dopant concentration, sizes, surface quality and coating. For special request, please specify specification in details for evaluation and fabrication.

Other crystal such as Yb:$GdVO_4$, Nd:$Gd_{0.5}Y_{0.5}VO_4$ etc. are available upon requirement.

Physical and Optical Properties:

Crystal Structure	Zircon Tetragonal, space group D4h, a=b=7.21, c=6.35
Melting Point	1780°C
Density	5.47g/ cm^3
Mohs Hardness	Glass-like, ~ 5
Thermal Expansion Coefficient	α_a=1.5x10^{-6}/K, α_c=7.3x10^{-6}/K
Thermal Conductivity Coefficient	11.7 W/m/K <110>
Peak Absorption Wavelength	808.5 nm
Lasing Wavelength	912.6 nm, 1063.1 nm, 1341.3 nm
Crystal Class	Positive uniaxial, n_o=n_a=n_b n_e=n_c n_o=1.9854, n_e=2.1981,@ 1064nm n_o=2.0382, n_e=2.2929, @ 532nm n_o=1.9977, n_e=2.2198, @ 808nm
Thermal Optical Coefficient	dn/dT=4.7x10^{-6}/K
Stimulated Emission Cross-Section	7.60x$10^{-19}$$cm^2$, @1064 nm^2
Fluorescent Lifetime Nd=1.2 atm%	95 μs @ 808 nm
Loss Coefficient	0.003 cm^{-1}@ 1064 nm
Absorption Coefficience Nd=1.2 atm%	74 cm^{-1} @ 808 nm
Absorption Length Nd=1.2 atm%	0.18 mm @ 808 nm
Intrinsic Loss Nd=1.2 atm%	Less 0.1% cm^{-1} , @1064 nm
Line width	0.6 nm
Polarized Laser Emission	π parallel to optic axis (c-axis)
Diode Pumped Optical to Optical Efficiency	> 60%
Sellmeier Equation (for pure GdVO4 crystals)	n_e^2=4.734369 + 0.1216149/(λ^2 - 0.0523664) - 0.013927λ^2 n_o^2=3.8987165+0.05990622/(λ^2 - 0.0514395) - 0.011319λ^2

Nd:$GdVO_4$ properties compare with Nd:YVO_4

	Nd:$GdVO_4$, 1.2 atm% Nd	Nd:YVO_4, 1.1 atm% Nd
Melting temperature (°C)	1780	1825
Fluorescence lifetime (τ)	95 μs	100 μs
Stimulated emission cross section (σ)	7.6x$10^{-19}$$cm^{-2}$	15.6x$10^{-19}$$cm^2$ (π-pol)
Absorption coefficient	78cm^{-1}	31.2cm^{-1}
La	0.18mm	0.32mm
Threshold power	70 MW/cm^2	78 MW/cm^2
Conversion efficiency η_s	50%	48.6%
Thermal conductivity coefficient	11.7w/m/k	5.10w/m/k

Marks and handling of the crystal; same as Nd:YVO_4, See Page 84.

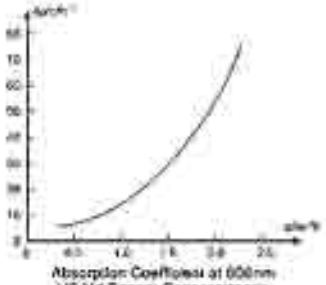
Nd:YVO_4

Yttrium vanadate has been growing in popularity because of its high gain, low lasing threshold, and high absorption coefficients at pumping wavelengths, which result from the excellent fit of the neodymium dopant in the crystal lattice. These advantages make Nd:YVO_4 is a better choice than Nd:YAG for low-power devices such as hand-held pointers, and others compact lasers.

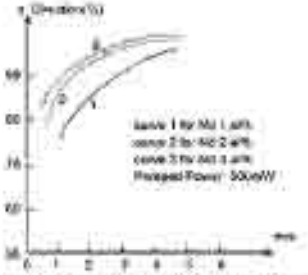
With advanced technology on growing and manufacturing high optical quality Nd:YVO_4 crystals, FOCtek can provide a wide variety of finished crystals.

Capabilities:

1) Nd Dopant Concentration:	0.1 ~ 3 atm% Tolerance within 10% of concentration
2) Width x Height:	1x1 ~ 16x16mm
3) Length:	0.02 ~ 20mm



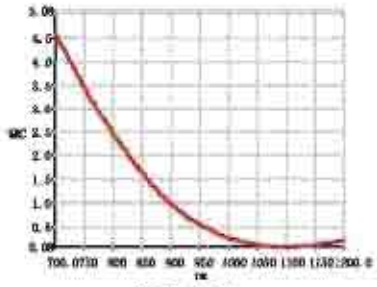
Absorption Coefficient at 808nm VS Nd Dopant Concentrations

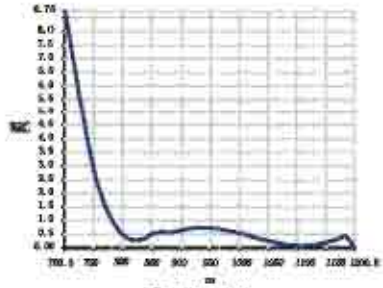


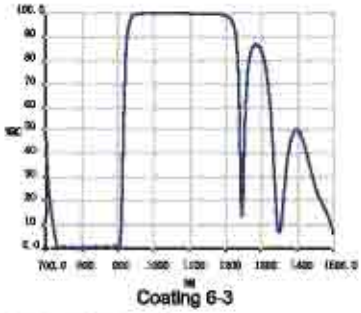
Nd:YVO4 Absorption Efficiency VS Length

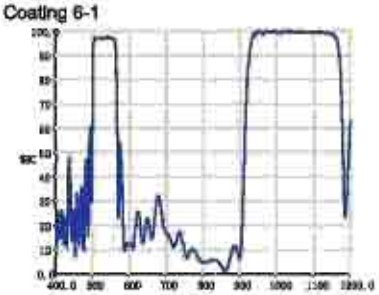
Typical Specification and Tolerance:

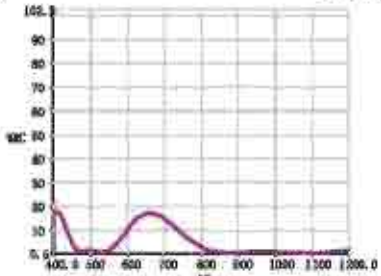
1) Orientation:	a-cut crystalline direction (+/-0.2°C)
2) Dimensional Tolerance:	+/-0.1mm(typical), +/-0.005mm can be available for High precision.
3) Wavefront Distortion:	< λ/8 at 633nm
4) Surface Quality:	better than 20/10 Scratch/Dig per MIL-O-1380A
5) Parallelism:	< 10 arc seconds
6) Perpendicularity:	< 5 arc minutes
7) Surface Flatness:	< λ /10 at 632.8nm
8) Clear Aperture:	Central 95%
9) Chamfer:	0.15mmx45°
10) Damage Threshold:	> 15J/cm²(rods without coating) > 700 MW/ cm² (coating)
11) Coating:	1) AR@1064nm, R<0.1%;(see coating 6-1) 2) AR@1064nm, R< 0.1%; HT@808nm, T>95%;(see coating 6-2) 3) HR@1064nm, R>99.8%; HT@808nm, T>95%;(see coating 6-3) 4) HR@1064nm, R>99.8%; HR@532nm, R>95%& HT@808nm, T>95%;(see coating 6-4) 5) AR@1064nm, R<0.1%; AR@532nm, R<0.3%;(see coating 6-5)


Coating 6-1


Coating 6-2


Coating 6-3


Coating 6-4


Coating 6-5

Lasing Wavelengths		914nm, 1064 nm, 1342 nm
Crystal class		positive uniaxial, $n_o=n_a=n_b$, $n_e=n_c$, n_o=1.9573, n_e=2.1652, @ 1064nm n_o=1.9721, n_e=2.1858, @ 808nm n_o=2.0210, n_e=2.2560, @ 532nm
Thermal Optical Coefficient		$dn_a/dT=8.5\times10^{-6}$/K, $dn_c/dT=3.0\times10^{-6}$/K
Stimulated Emission Cross-Section		25.0×10^{-19} cm^2 , @1064 nm
Fluorescent Lifetime	Nd=1.1 atm% Nd=2.0 atm%	90μs @808nm 50μs @808nm
Absorption Coefficient	Nd=1.1 atm%	31.4 cm^{-1} @ 808 nm
Absorption Length	Nd=1.1 atm%	0.32 mm @ 808 nm
Intrinsic Loss	Nd=1.1 atm%	Less 0.1% cm^{-1} , @1064 nm
Gain Bandwidth		0.96 nm (257 GHz) @ 1064 nm
Polarized Laser Emission		π polarization; parallel to optic axis (c-axis)
Diode Pumped Optical to Optical Efficiency		> 60%
Sellmeier Equation (for pure YVO4 crystals)		$n_o^2 = 3.77834 + 0.069736/(\lambda^2 - 0.04724) - 0.0108133.\lambda^2$ $n_e^2 = 4.59905 + 0.110534/(\lambda^2 - 0.04813) - 0.0122676.\lambda^2$

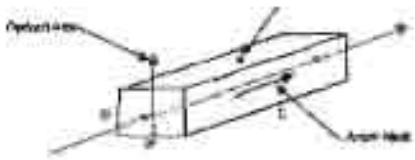
Atomic Density	~1.37x1020 atoms/cm^3
Crystal Structure	Zircon Tetragonal, space group D_{4h}, a=b=7.12, c=6.29
Density	4.22 g/cm^3
Mohs Hardness	Glass-like, ~5
Thermal Expansion Coefficient	$\alpha_a=4.43\times10^{-6}$/K, $\alpha_c=11.37\times10^{-6}$/K
Thermal Conductivity Coefficient	∥C: 5.23 W/m/K; ⊥C: 5.10 W/m/K

How to handle the Nd:YVO4 crystal

When you receive crystals from FOCtek, please make sure that only qualified personnel are able to open inner packing at clean environment. Please prevent finger print, oil and other substances from adhering to the polished or coated surfaces.

If the surfaces are contaminated, please blow the surfaces with air ball. If there is still pollution on the crystal surfaces, please clean the surfaces with cleaning liquid and soft silk. The mixing liquid of 50% high purity alcohol and 50% high purity ether is recommended as cleaning liquid. Please notify that the contaminated surfaces are very easy to be damaged. When polished surfaces are fogged or damaged, please ask FOCtek for repolishing and coating service.

Marks on the crystals



For general a-cut Nd:YVO4, there is a dot mark on the surface, which normal to the optical axis. And, if the coating is different on the input and output surface, there is an arrow mark on the cruystal side surface, which direct from input surface to output surface.

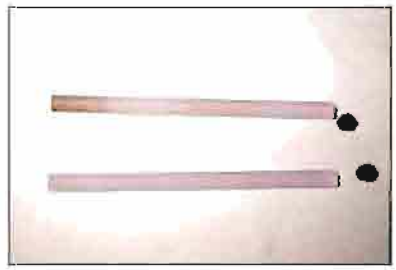
Standard Products Series

FOCtek have a lot of standard series kits of diode pumped laser optics, it's easy to select what you need listed below.

Part	Size (mm)	Nd	Coatings	
			S1	S2
NYV001	3x3x1	0.5%	AR@1064nm, HT@808nm	AR@1064nm,
NYV002	3x3x1	1%	AR@1064nm, HT@808nm	AR@1064nm,
NYV003	3x3x1	1%	HR@1064nm, HT@808nm,	AR@1064nm,
NYV004	3x3x1	1%	HR@1064nm,HT@808nm,HR@532nm	AR@1064nm,
NYV005	3x3x3	0.5%	AR@1064nm, HT@808nm	AR@1064nm, HT@808nm
NYV006	3x3x3	0.5%	HR@1064nm, HT@808nm	AR@1064nm, HT@808nm
NYV007	3x3x5	0.5%	AR@1064nm, HT@808nm	AR@1064nm, HT@808nm
NYV008	3x3x8	0.5%	AR@1064nm, HT@808nm	AR@1064nm, HT@808nm
NYV009	3x3x12	0.5%	AR@1064nm, HT@808nm	AR@1064nm, HT@808nm
NYV010	3x3x3	1.0%	AR@1064nm, HT@808nm	AR@1064nm, HT@808nm
NYV011	3x3x3	1.0%	HR@1064nm, HT@808nm	AR@1064nm, HT@808nm
NYV101	3x3x0.5	3.0%	HR@1064nm, HR@532nm,HT@808nm	AR@1064nm&532 nm
NYV102	3x3x1	1.0%	HR@1064nm, HR@532nm,HT@808nm	AR@1064nm&532 nm
NYV103	3x3x1	2.0%	HR@1064nm, HR@532nm,HT@808nm	AR@1064nm&532 nm
NYV104	3x3x3	1.0%	HR@1064nm, HR@532nm,HT@808nm	AR@1064nm&532 nm
NYV105	3x3x5	0.5%	HR@1064nm, HR@532nm,HT@808nm	AR@1064nm&532 nm
NYV106	3x3x2	1.0%	HR@1064nm, HR@532nm,HT@808nm	AR@1064nm&532 nm
NYV107	3x3x2	0.5%	HR@1064nm, HR@532nm,HT@808nm	AR@1064nm&532 nm

Nd:YAG

Although Nd:YAG was invented in the sixties last century, it has been and is still the most commonly used solid-state crystal material. Nd:YAG crystals are widely used in all types of solid-state lasers systems-frequency-doubled continuous wave, high-energy Q-switched, and so forth.



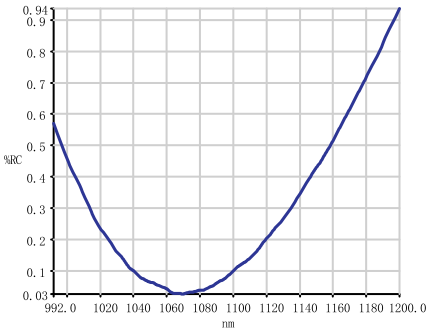
Its good fluorescent lifetime thermal conductivity and physical strengths makes it suitable for high power lamp pumped laser

Capabilities:

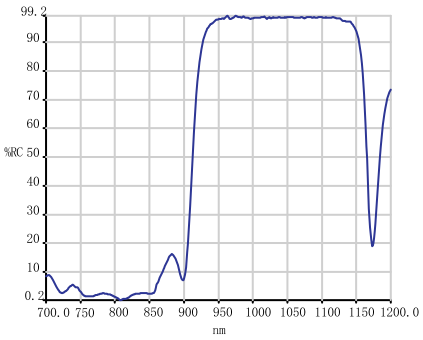
1) Nd Dopant Concentration:	0.5-1.2 atm% tolerance within 10% of concentration.
2) Diameter:	3 ~ 14mm
3) Length:	1~ 180mm

Typical Specification and Tolerance:

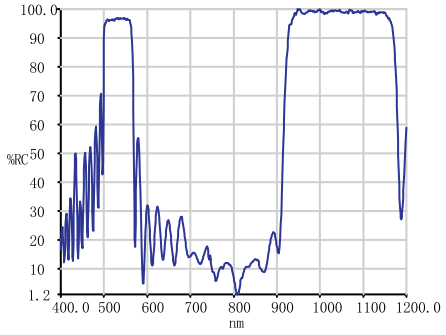
1) Orientation:	<111> crystalline direction (+/-0. 5°C)
2) Wavefront Distortion:	< λ /10 at 632.8nm for 3 ~ 7mm
	< λ /8 per inch at 632.8nm for >=7mm
3) Surface Quality:	better than 20/10 Scratch/Dig per MIL-O-1380A
4) Parallelism:	< 10 arc seconds
5) Perpendicularity:	< 5 arc minutes
6) Surface Flatness:	< λ /10 at 632.8nm
7) Clear Aperture:	Central 90%
8) Chamfer:	0.15x45°
9) Damage Threshold:	> 15J/cm² (uncoated)
	> 700 MW/c m² (coated)
10) Coatings:	a) AR@1064nm, R<0.1%;(see coating 9-1)
	b) AR@1064nm, R< 0.1%; HT@808nm, T>95%;(see coating 6-2)
	c) HR@1064nm, R>99.8%; HT@808nm, T>95%;(see coating 9-2)
	d) HR@1064nm, R>99.8%; HT@808nm, T>95%; HR@532nm, R>99%;(see coating 9-3)



coating 9-1



coating 9-2



coating 9-3

Notes:

To inquiry or order a finished Nd:YAG laser rod, please specify each specification listed above, for common application, we only need to know the main specification: Nd-dopant concentration, size, and coating. For special request, please specify specification in details for evaluation and fabrication.

Physical and Optical Properties:

Chemical Formula	Nd:$Y_3Al_5O_{12}$
Crystal Structure	Cubic
Lattice Constants	12.01Å
Concentration	~1.2x10 ^{20}cm $^{-3}$
Melting Piont	1970°C
Density	4.56g/cm ^{3}
Mohs Hardness	8.5
Refractive Index	1.82
Thermal Expansion Coefficient	7.8x10 $^{-6}$/K[111],0-250°C
Thermal Conductivity	14W/m /K@20°C,10.5W /m /K@100°C

Lasing Wavelength	1064nm
Stimulated Emission Cross Section	2.8x10 $^{-19}$cm $^{-2}$
Relaxation Time of Terminal Lasing Level	30ns
Radiative Lifetime (Nd=1.1atm%)	550 μs
Spontaneous Fluorescence (Nd=1.1atm%)	230 μs
Loss Coefficient (Nd=1.1atm%)	0.003 cm $^{-1}$@ 1064 nm
Effective Emission Cross Section	2.8 x 10 $^{-19}$cm ^{2}
Pump Wavelength	807.5 nm
Absorption Band at Pump Wavelength	1 nm
Linewidth	0.6 nm
Polarized Emission	Unpolarized
Thermal Birefringence	High

Ti:Sapphire

$Ti^{3+}:Al_2O_3$:- titanium-doped sapphire crystals combine excellent physical and optical properties with broadest lasing range. It's indefinitely long stability and useful lifetime added to the lasing over entire band of 660-1050 nm challenges "dirty" dyes in variety of applications.

The absorption band of Ti:Sapphire centered at 490 nm makes it suitable for variety of laser pump sources, such as argon ion, frequency doubled Nd:YAG and YLF, copper vapour lasers. Because of 3.2μs fluorescence lifetime, Ti:Sapphire crystals can be effectively pumped by short pulse flashlamps in powerful laser systems.

Capabilities;

1) Ti_2O_3 Conentration:	0.06-0.5 wt%
2) Figure of Merit:	100~300
3) Diameter:	2~50mm
4) Path Length:	2~130mm
5) End Configuration:	flat/flat or Brewster/Brewster ends or Specified

Typical specification and tolerance:

1) Orientation:	Optical axis C normal to rod axis
2) α_{488}:	1.0-7.5cm^{-1}
3) Flatness:	<λ/10 @633nm
4) Parallelism:	<10 arc seconds
5) Surface Quality:	better than 60/40 scratch/dig per MIL-O-13830A
6) Wavefront Distortion:	<λ/4 per inch @ 633 nm

Coating: We can make any kind coating on Ti:Saphire upon your requirment, Please specify when order.

Physical and Optical Properties:

Chemical Formula	$Ti^{3+}:Al_2O_3$
Crystal Structure	Hexagonal
Melting Point	2050 °C
Density	3.98 g/cm^3
Mohs Hardness	9
Thermal Conductivity	0.11 cal/(°C x sec x cm)
Specific Heat	0.10 cal/g
Laser Action	4-Level Vibronic
Lattice Constants	a = 4.748, c = 12.957
Fluorescence Lifetime	3.2 μsec (T = 300 K)
Tuning Range	660-1050 nm
Absorbtion Range	400-600 nm
Emission Peak	795 nm
Absorption Peak	488 nm
Refractive Index	1.76 @ 800 nm

Er: Doped Phosphate Glass

Erbium and ytterbium co-doped phosphate glass has a broad application because of the excellent properties. Mostly, it is the best material for 1.54 ough atmosphere. It's also suitable for medical applications where the need for eye protection may be difficult to manage or diminish or hinder essential visual observation. Recently it is used in optical fiber communication instead of EDFA There is a great progress in this field. We can also produce erbium laser glass with various ion doping according to your requirement. We have three kinds of Erbium-doped glasses. EP6, WM4, Cr14.

Optical Properties	EP6
Non-linear refractive index coeff.n2 ($x10^{-13}$ e.s.u)	1.2
n (1540nm)	1.532
nd	1.544
Abbe value	65
dn/dT (10^{-6}/°C) (20～100°C)	-4.7
Coeff.of linear thermal expansion (10^{-6}/°C) (20～100°C)	10
Thermal coeff.of optical path length (10^{-6}/°C) (20 ～ 100°C)	0.64

Laser Properties	EP6
Cross section for stimulated emission ($10^{-20}cm^2$)	0.8
Fluorescent lifetime (usec)	9000
Center lasing wavelength (nm)	1535

Thermal Properties	EP6
Transformation temp. (°C)	442
Softening temp. (°C)	470
Coeff.of linear thermal expansion (10^{-6} /°C) (100 ～ Tg°C)	13

Other Properties	EP6
Desity (g/cm^3)	3.15
Chemical durability (weigh loss rate at 85°C distilled water)	70ug/hr.cm

Erbium phosphate glass for xenon lamp or laser diode pumping laser device

Properties	EP6
nd	1.5359
Desity (g/cm^3)	3.1
n at lasing wavelength	1.53
V	64
Stimulated cross section (pm^2)	0.8
Fluorescent lifetime (ms)	7.7
Radiative lifetime (ms)	8.8
FWHM (nm)	29
Tg (°C)	455
Tf (^{0}C)	493
a(25-80°C) (10^{-7}/K)	103
a(25-300°C) (10^{-7}/K)	127
dn/dT (10^{-7}/K)	-52
ds/dT (10^{-7}/K)	3.6

Nd: Doped Phosphate Glass

Nd doped phosphate glass have been widely used in high average power laser solid state lasers, laser material processing, range finder and other industrial and scientific applications.

LLG mainly offers two types of Nd3+ doped phosphate glasses-N21 and N31. LLG Nd3+ phosphate glasses are guaranteed in optical qualities such as homogeneity, striation, stress birefringence, Pt inclusions etc. The different n eodymium doping phosphate glass are ready for your quest. We have stocked 0.7%, 3.0%, and 4.0% doped N31 and N21.

Laser Properties	N21	N31
Nd2O3 (wt%)	2.2	2.2
Nd3+ conc. (10^{20}ions/cm^3)	2.68	2.26
Cross section for stimulated emission (10^{-20}cm^2)	3.40±0.3	4.0±0.3
Life time	330	340±10
Fluorescence half-line width at 290^{0}K(Å)	240	201
Center lasing wavelength (nm)	1053	1053

Thermal Properties	N21	N31
Transformation temp. (°C)	500	430
Softening temp. (°C)	530	475
Coeff.of linear thermal expansion (10^{-6}/°C) (100 ～Tg°C)	12.0	122.7
Thermal conductivity (25°C) (10^{-3} w/cm°C)	5.53	5.58
Specific heat (25°C) (J/cm^3 °C)	0.75	0.75

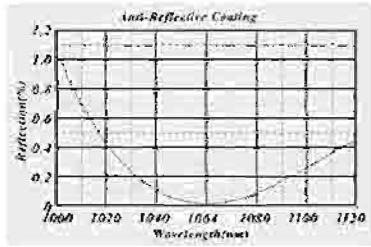
Optical Properties	N21	N31
Non-linear refractive index coeff.n2(x10^{-13} e.s.u)	1.3±0.1	1.1±0.1
n (1053nm)	1.5652	1.528
n_d	1.5758	1.5357
n_F	1.5731	1.5413
n_c	1.582	1.5332
Abbe value	65.3	66.2
dn/dT (10^{-6}/°C) (20 ～ 100°C)	-4.2	-4.3
Coeff.of linear thermal expansion (10^{-6}/°C) (20～100°C)	11	10.7
Thermal coeff.of optical path length (10^{-6}/°C) (20～100°C)	1.9	1.4

Chemical Properties	N21	N31
Dw (H_2O 100°C 1hr) (wt.Loss%)	0.06	0.98
DA (HNO_3pH2.2 100°C 1hr) (wt.loss%)	0.3	0.4

Other Properties	N21	N31
Density (g/cm^3)	3.4	2.83
Young's modulus (Kgf/mm^2)	5647	5270
Posson's ratio	0.27	0.27
Knoop hardness (Kg/cm^2)	650	630

Cr^{4+}:YAG

Passive Q-Switching has advantages of passive (no necessary for the input power), compact, low cost and easy to manufacture and operate. Cr:YAG is an excellent passive Q-switch crystals for Nd and Yb doped laser whose wavelength is in the range of 900-1200 nm, especially for the diode pumped or lamp pumped Nd:YAG, Nd:YLF and Yb:YAG. Due to Cr:YAG has chemically stable, durable, UV resistant, good thermal conductivity and high damage threshold (> 500 MW/cm²), it will replace traditional materials, such as, LiF, organic Dye and
color centers for passive Q-switching application.



Coating 11-1

Capabilities

1) Cr^{4+} Dopant Concentration:	0.5 mol% ~ 3 mol%
2) Aperture:	2x2 ~ 14x14mm
3) Length:	0.1 ~ 12mm
4) Initial Transmission:	10% ~ 98%

Typical Specification and Tolerance:

1) Dimension Tolerance:	(W ± 0.1mm) x (H ± 0.1mm) x (L + 0.2mm/-0.1mm)
2) Flatness:	< λ/8 @ 633nm
3) Scratch/Dig Code:	better than 10/5 Scratch/dig per MIL-O-13830A
4) Parallelism:	< 20 arc seconds
5) Perpendicularity:	< 5 arc minutes
6) Wavefront Distortion:	< λ/8 @ 633nm
7) Clear Aperture:	> 90% central area
8) Coating:	Anti-reflective @ 1064 nm, R<0.1%; (See Coating 11-1)

Notes::

To inquiry or order a finished Cr4+:YAG crystals, please specify the specification listed above in particular the size, initial transmission and coatings.

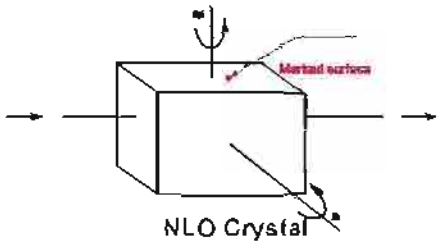
Physical and Optical Properties:

Chemical Formula	$Cr^{4+}:Y_3Al_5O_{12}$
Crystal Structure	Cubic garnet
Recovery Time	8.5 μs
Hardness	Mohs 8.5
Density	4.56g/cm
Orientation	[100]+/-10°
Thermal Conductivity	12.13w/m/k
Refractive Index	1.82 @ 1064nm
Base state absorption cross section	$\sigma s_1=4.3x10^{-18}cm^2$
Emission state absorption cross section	$\sigma s_2=8.2x10^{-19}cm^2$
Fluorescence lifetime	3.4us

How to Order A Right NLO Crystal

Angle Tilting

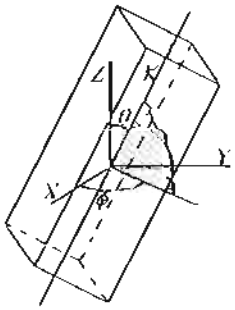
In order to obtain maximum conversion efficiency, angle tilting is normally used to reach phase-matching direction. There are two axes for tilting crystal angles as shown in the right figure. Because the NLO crystals provided by Foctek are normally cut in a principal crystal plane, conversion efficiency isn't sensitive to the angle tilting around n-axis. However, it is very sensitive to the angle tilting around m-axis which is called tilting axis of NLO crystals and is normal to marked surface. Customers have to pay great attention when rotating the crystal around m-axis. A crystal mount with angle accuracy of about 5 arc second is recommended.



Crystal Angle Tilting

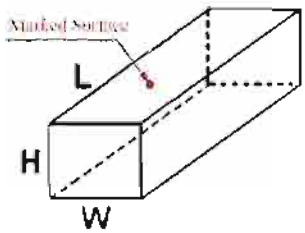
Optimum Crystal Size and Cut

When ordering a nonlinear optical crystal, crystal orientation (or crystal cut) and size have to be known. The orientation is solely determined by the nonlinear optical process. For example, for type I frequency-doubling of 1.064μm, BBO is cut at $\theta = 22.8°$ and $\phi = 0°$. Where:θ is the polar angle between the optical axis and the propagation direction, ϕ is the azimuthal angle between the projection of propagation direction onto the XY plane and the X axis. If you aren't sure about the crystal orientation and merely provide the nonlinear optical process of your application, Foctek's salesmen and engineers will help you.



Polar Coordinate System in Crystal
(K is the light propagation direction)

The crystal size is divided into three dimensions, Width(W), Height(H) and Length(L), which is common written as W x H x L mm^3 . The careful design of crystal size is important because the price of crystal varies from crystal sizes. More important, the conversion efficiency has direct relation to crystal length.



Dimensions of Crystal

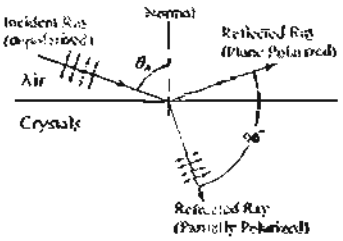
To select the optimum crystal height (H), the laser beam diameter upon the crystal should be taken into account. The optimum crystal height should be slightly (for instance, 1 mm to 2mm) larger than the laser beam diameter upon the crystal.

Both of laser beam diameter upon NLO crystal and tunable wavelength range have to be considered when designing the optimum crystal width (W). If it is a single NLO process, for example, frequency doubling 532 nm, we select W = H. If it is wide wavelength tuning NLO process, for example, frequency doubling a Dye laser from 44* nm to 66* nm by using BBO crystal, the crystal should be tuned from θ = 36* to θ = 66.6°. The width (W) is set to H + 2xtg((66.6°- 38°)/2)xL. Because if the crystal height (H) is 4 mm and length (L) is 7 mm, the W should be approximately 8 mm long.

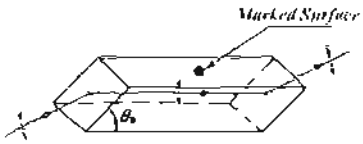
Every NLO crystal has a standard length (L) for frequency doubling lasers with pulse width longer than nanosecond (ns). For example, the standard crystal lengths for BBO and KTP are 7 mm and 5 mm, respectively. However, OPO and OPA need longer length, for example, > 12 mm for BBO, and the SHG and THG of ultrashort pulse lasers use thin crystals with length of less than 1 mm. Foctek's salesmen and engineers collected a series of standard crystal lengths for various applications. This information is provided free.

Brewster's angle NLO crystals

For laser beam propagates from Air to NLO crystal (with refractiveindices n). Brewster's angle is defined as θ_B=arctan(n). At Brewster's angle, the surface reflectance is zero for the light with polarization inside the plane defined by the direction of light propagation and the normal to the surface.

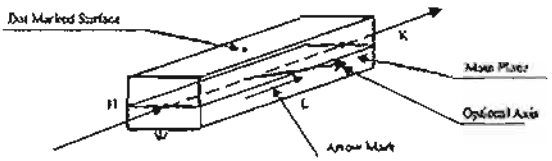


In order to have a low surface reflection, Brewster's angle cut (B-cut) NLO crystals are used. Without special notices, Foctek will fabricate the standard B-cut crystals according to the enclosed drawing. If customers design different sketch from our standard one, please notify Foctek by giving us a drawing



What is the Marked Surface:

The surface consists of Z, the optical axis and K, the light propagation direction is called as main plane. Foctek's NLO crystals are dot marked on the crystal surface which parallel the optical axis and main plane. As shown as the drawing. The dot marked surface is called marked surafce.



Meanwhile, if the coating is different on the input and output surface, there is an arrow mark on the

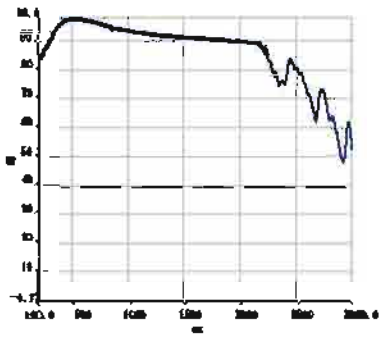
How to handle a NLO crystal

When you receive crystals from FOCTEK, please make sure that only qualified personnel are able to open inner plastic boxes at clean environment. When the plastic box of a NLO crystal is opened, please prevent finger print, oil and other substances from adhering to the polished or coated surfaces.
If the surfaces are contaminated, please blow the surfaces with air ball. If there is still pollution on the crystal surfaces, please clean the surfaces with cleaning liquid and soft silk. For BBO crystal, the mixing liquid of 50% high purity alcohol and 50% high purity ether is recommended as cleaning liquid. Please notify that the contaminated surfaces are very easy to be damaged.

Some NLO crystals have a low susceptibility to moisture, you are advised to provide dry atmosphere conditions for both use and preservation of them. When polished surfaces are fogged or damaged, please ask FOCTEK for repolishing and coating service.

BBO

BBO (beta-BaB_2O_4) is a nonlinear optical crystal with combination of number of unique features. Wide transparency and phase matching ranges, large nonlinear coefficient, high damage threshold and excellent optical homogeneity provide attractive possibilities for various nonlinear optical applications.

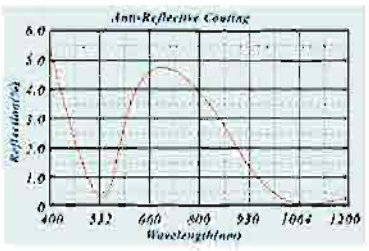


Capabilities:

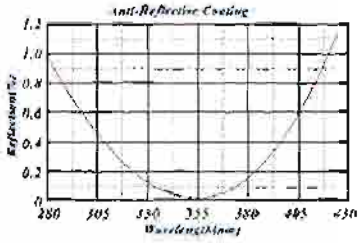
1) Aperture:	1x1 ~ 12x12mm
2) Length:	0.02 ~ 25mm
3) Phase Matching Angle θ and ϕ :	Determined by different kinds of homonic generartion.
4) Phase Matching Type	Type I or Type II
5) End Configuration:	Flat or Brewster or Specified

Typical specification and tolerance:

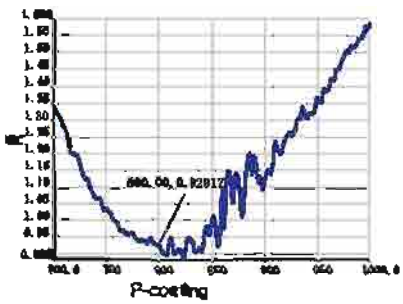
1) Angle Tolerance:	$\Delta\theta < \pm 0.2°$; $\Delta\phi < \pm 0.2°$
2) Dimension Tolerance:	(W ± 0.1mm) x (H ± 0.1mm) x (L + 0.2mm/-0.1mm)
3) Flatness:	$\leq\lambda/8$ @ 633nm
4) Scratch/Dig Code:	better than 10/5 Scratch/dig per MIL-O-13830A
5) Parallelism:	< 20 arc seconds
6) Perpendicularity:	< 5 arc minutes
7) Wavefront Distortion:	< λ/8 @ 633nm
8) Clear Aperture:	> 90% central area
9) Coating:	Protective Coating or Anti-Reflection



AR@1064nm R<0.2% + AR@532nm R<0.



AR@355nm R<0.2%



P-coating

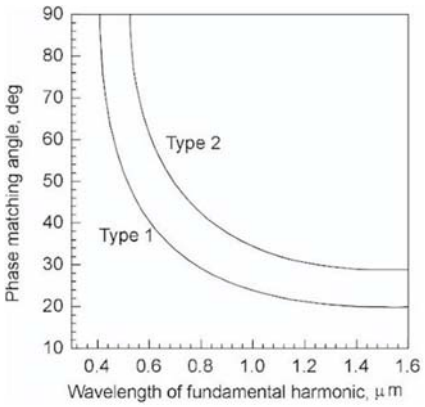
Physical and Optical Properties:

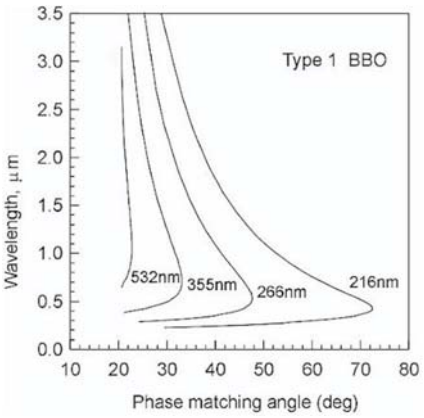
Crystal Structure	trigonal,space group R3c
Cell Parameters	A=b=12.532Å,c=12.717Å,Z=6
Melting Point	1095+/-5°C
Transition Temperature	925+/-5 °C
Optical Homogeneity	$\Delta n \approx 10^{-6}$/cm
Mohs Hardness	4.5
Density	3.85 g/cm^3
Absorption Coefficient	<0.1%/cm (at 1064nm)
Hygroscopic Susceptibility	low
Resistivity	>10^{11} ohm-cm
Relative Dielectric Constant	$\varepsilon^T_{11}/\varepsilon_0$:6.7, $\varepsilon^T_{33}/\varepsilon_0$:8.1 Tanδ < 0.001
Thermal Expansion Coefficients (in the range of 25°C-900°C	a, 4x10^{-6}/K c, 36x10^{-6}/K
Thermal Conductivity	⊥c, 1.2 W/m/K ; ∥c, 1.6W/m/K

Phase-Matchable SHG Range	189-1750nm
NLO Coefficients	d_{11}=5.8 x d_{36}(KDP) d_{31}=0.05 x d_{11}, d_{22} < 0.05 xd_{11}
Electro-Optic Coefficients	γ_{11}=2.7 pm/V , γ_{22},γ_{31} < 0.1γ_{11}
Half-Wave Voltage	48 KV (at 1064 nm)
Damage Threshold at 1.064 μm at 0.532 μm	 5 GW/cm^2 (10 ns); 10 GW/cm^2 (1.3ns) 1 GW/cm^2 (10 ns); 7 GW/cm^2 (250ps)
Transparency Range	189-3500 nm
Refractive Indices at 1.0642 μm at 0.5321 μm at 0.2660 μm	 n_e=1.5425, n_o=1.6551 n_e=1.5555, n_o=1.6749 n_e=1.6146, n_o=1.7571
Therm-Optic Coefficients	dn_o/dT=-9.3 x 10^{-6}/°C dn_e/dT=-16.6 x 10^{-6}/°C
Sellmeier Equations	n_o^2 (λ)=2.7359 + 0.01878/(λ^2 -0.01822)-0.01354λ^2 n_e^2 (λ)=2.3753 + 0.01224/(λ^2 -0.01667)-0.01516λ^2

As a result of large thermal acceptance bandwidth, high damage threshold and small absorption BBO well suits for frequency conversion of high peak or average power laser radiation.The large spectral transmission range as well as phase matchability, especially in UV range, makes BBO perfectly suitable for frequency doubling of Dye, Ar+-ion and Copper vapour laser radiation, effective cascade harmonic generation of wide spread Nd:YAG as well as of Ti:Sapphire and Alexandrite laser radiation. Both angle tuned Type 1 (oo-e) and Type 2 (eo-e) of phase matching can be obtained increasing a number of advantages for different applications.SHG phase matching angle dependence on input radiation wavelength is shown in fig. 1

Both Type 1 and Type 2 phase matching are used in OPO devices based on BBO crystals and designed for pump at different harmonics (up to fifth) of Nd:YAG lasers. Type 1 of interaction gives a larger tuning range and higher parametric amplification rate comparing to type 2 of interaction, while using type 2 interaction you're obtaining narrower bandwidth of output. Parametric gain in BBO is about10 times higher then in KDP in case of 355 nm pump for type 1 interaction. Up to 30% energy conversion efficiency has been obtained using BBO crystal of 12 mm length in OPO device synchronously pumped at 532 nm, which outputs at 406-3170 nm. Because of small acceptance angle and large walk off, the use of input laser radiation with good beam quality and low divergence is required for efficient conversion.

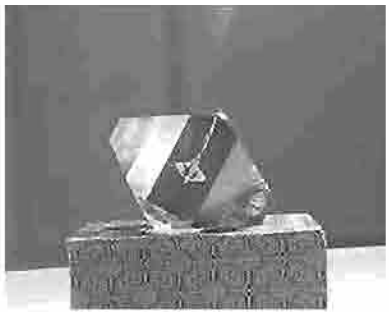




Standard BBO for SHG

Part No.	Size(mm)	θ	ϕ	Coating
BBO001	4x4x7	22.8°	0°	AR/AR@1064&532nm
BBO002	4x4x7	47.6°	0°	AR/AR@532&266nm
BBO003	4x4x10	22.8°	0°	AR/AR@1064&532nm
BBO004	4x4x10	47.6°	0°	AR/AR@532&266nm
BBO005	5x5x2	29.2°	0°	AR/AR@800&400nm
BBO006	5x5x1	29.2°	0°	AR/AR@800&400nm
BBO007	5x5x0.3-0.5	29.2°	0°	AR/AR@800&400nm
BBO008	5x5x0.1	29.2°	0°	AR/AR@800&400nm

KTP

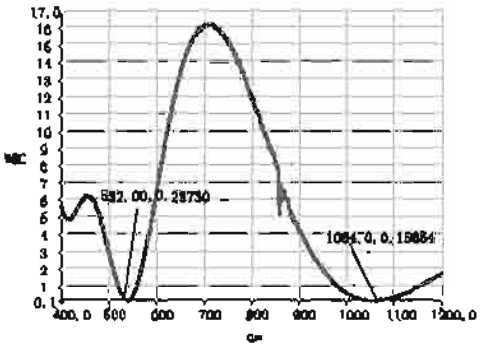


KTP ($KTiOPO_4$) is a nonlinear optical crystal, which possesses excellent nonlinear and electro-optic properties. It has large nonlinear optical coefficients and wide angular bandwidth and small walk-off angle, etc, which make it suitable for various nonlinear frequency conversion and wave guide application.

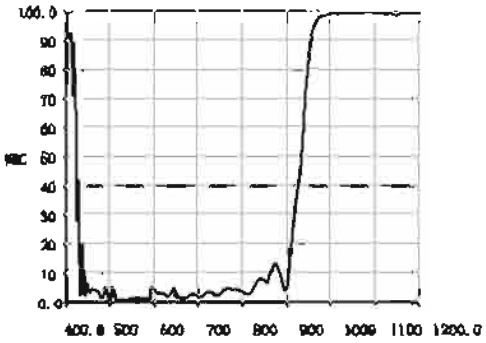
Due to very high effective nonlinearity (d_{eff}~8.3 x d_{36}(KDP) at 1.06μm) and excellent optical properties, KTP perfectly suits as lasing material in various applications. The phase matching range of KTP crystal lies in 0.99-3.3 μm region. This allows us to use KTP as an intracavity and extracavity frequency doubler for the most commonly used lasers, such as Nd:YAG, Nd:Glass and Nd:YLF

Capabilities:

1) Aperture:	1x1 ~ 10x10mm
2) Length:	0.05 ~ 20mm
3) Phase Matching Angle:	Determined by different homonic generation (θ=90°; ϕ=23.5° for SHG 1064nm)
4) Phase Matching Type:	Type II
5) Typical Coating:	a) AR @1064nm R<0.1%; AR @ 532nm, R<0.25%(See Coating 18-1)
	b) HR @1064nm, R>99.8%; AR @532nm, R<0.5%(See Coating 18-2)
	Different coating specification is available upon customer request.



Coating 18-1



Coating 18-2

Typical Specification and Tolerance:

1) Angle Tolerance:	Δθ < ± 0.2°; Δϕ < ±0.2°
2) Dimension Tolerance:	(W ± 0.1mm) x (H ± 0.1mm) x (L + 0.2mm/-0.1mm)
3) Flatness:	< λ/8 @ 633nm
4) Scratch/Dig Code:	better than 10/5 Scratch/dig per MIL-O-13830A
5) Parallelism:	< 20 arc seconds
6) Perpendicularity:	< 5 arc minutes
7) Wavefront Distortion:	< λ/8 @ 633nm
8) Clear Aperture:	> 90% central area

Physical and Optical Properties:

Crystal Structure	Orthorhombic, point group mm^2
Melting Point	1172°C incongruent
Cell Parameters	a=6.404Å, b=10.616Å, c=12.814Å, Z=8
Curie Point	936°C
Mohs Hardness	~5
Density	3.01 g/cm^3
Color	colorless
Hygroscopic Susceptibility	no
Specific Heat	0.1643 cal/g.°C
Thermal Conductivity	0.13 W/cm/°K
Electrical Conductivity	$3.5x10^{-8}$ s/cm (c-axis, 22°C, 1KHz)

Transmitting Range	350nm~4500nm			
Refractive Indices		n_x	n_y	n_z
	1064nm	1.7377	1.7453	1.8297
	532nm	1.7780	1.7886	1.8887
Absorption Coefficients	α < 1% / cm @ 1.064 μm			
Phase Matchable Range	0.984-3.4μm			
Therm-Optic Coefficients	$dn_x / dT= 1.1x10^{-5}$/°C, $dn_y / dT= 1.3x10^{-5}$/°C, $dn_z / dT=1.6x10^{-5}$/°C			
Nonlinear Optical Coefficients	d_{31}=2.54pm/V, d_{32}=1.35pm/V, d_{33}=16.9pm/V d_{24}=3.64pm/V, d_{15}=1.91pm/V, at 1.064μm $d_{eff}(II) \approx (d_{24}-d_{15})\sin 2\Phi \sin 2\theta-(d_{10}\sin^2\Phi+d_{24}\cos^2\Phi)\sin\theta$			
Electro-Optic Coefficients		Low frequency (pm/V)		High frequency (pm/V)
	r13	9.5		8.8
	r23	15.7		13.8
	r33	36.3		35.0
	r51	7.3		6.9
	r42	9.3		8.8
Dielectric Constant	ε_{eff}=13			
Sellmeier Equations	$n_x^2 = 3.0065 + 0.03901/(\lambda^2 - 0.04251) - 0.01327\lambda^2$ $n_y^2 = 3.0333 + 0.04154/(\lambda^2 - 0.04547) - 0.01408\lambda^2$ $n_z^2 = 3.3134 + 0.05694/(\lambda^2 - 0.05658) - 0.01682\lambda^2$			

Fig. 1 represents Type 2 SHG tuning curve of KTP in x-y plane. In x-y plane the slope d(Dk)/dq is small. This corresponds to quasi-angular noncritical phase matching, which ensures the double advantage of a large acceptance angle and a small walk off

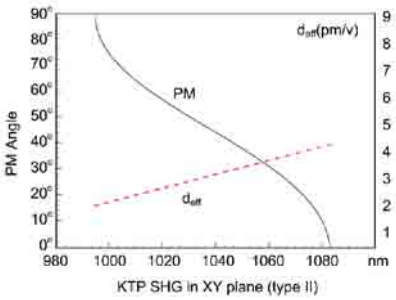


Fig.1

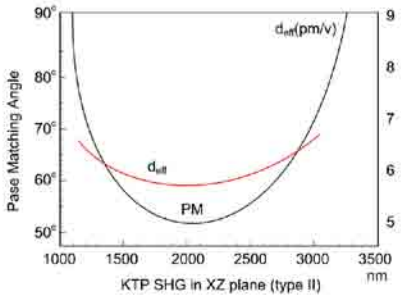


Fig.2

Fig. 2 represents Type 2 SHG tuning curve of KTP in x-z plane. in x-z plane the slope d(Dk)/dq is almost zero for wavelengths in the range 1.5-2.5 μm and this corresponds to quasi-wavelength noncritical phase matching, which ensures a large spectral acceptance. Wavelength noncritical phase matching is highly desirable for frequency conversion of short pulses.

Figures 3 and 4 show the phase matching angles for OPO/OPA pumped at 532 nm in x-y and x-z plane respectively. As a lasing material for OPG, OPA or OPO, KTP can most usefully be pumped by Nd lasers and their second harmonic or any other source with intermediate wavelength, such as a dye laser (near 600 nm).

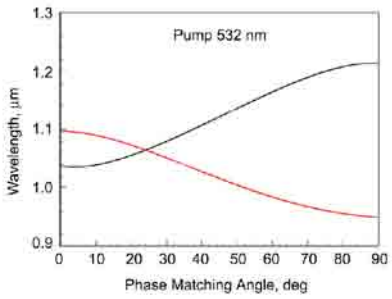


Fig.3

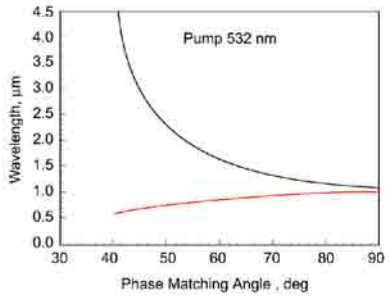


Fig.4

Standard KTP for SHG of 1064nm

Part NO.	Size (mm)	θ	Φ	Coating	
				S1	S2
KTP001	3x3x5	90°	23.5°	AR @ 1064nm R < 0.2% AR @ 532nm R < 0.5%	AR @ 1064nm R < 0.2% AR @ 532nm R < 0.5%
KTP002	3x3x5	90°	23.5°	HR@1064nm R > 99.8% AR @ 532nm R < 0.5%	AR @ 1064nm R < 0.2% AR @ 532nm R < 0.5%
KTP003	3x3x10	90°	23.5°	HR@1064nm R > 99.8% AR @ 532nm R < 0.5%	AR @ 1064nm R < 0.2% AR @ 532nm R < 0.5%

Notes:

To inquiry or order a finished KTP crystals, please specify the specification listed above, we kindly request engineering drawing to specify orientation. Please consult us for the designs if you're not sure about the phase matching angle for others' special application.

$LiNbO_3$

$LiNbO_3$ Crystal is widely used as frequency doublers for wavelength > 1 μm and optical parametric oscillators (OPOs) pumped at 1064 nm as well as quasi-phase-matched (QPM) devices. Due to its large Electro-Optic (E-O) and Acousto-Optic (A-O) coefficients.

FOCtek provides high quality and large size $LiNbO_3$ crystals for laser frequency doublers, OPOs and quasi-phase-matched doublers, as well as waveguide substrate and SAW wafers. High quality $LiNbO_3$ finished components with aperture of (2 - 15) x (2 - 15) mm^2 and length up to 50 mm for frequency doublers and optical parametric oscillators (OPOs), 50x50x1 mm^3 or Dia. 3" x 1 mm $LiNbO_3$ substrate for waveguide optics, and Dia. 3" SAW wafers are available with high volume and at low price.

Physical and Optical Properties:

Crystal Structure	Trigonal, space group R_{3c}
Cell Parameters	a = 5.15, c = 13.863, Z = 6
Melting Point	1255 +/-5 °C
Curie Point	1140 +/-5 °C
Mohs Hardness	5
Density	4.64 g/cm^3
Absorption Coefficient	~ 0.1%/cm @ 1064 nm
Solubility:	insoluble in H_2O
Relative Dielectric Constant	$\varepsilon^T_{11}/\varepsilon_0$: 85, $\varepsilon^T_{33}/\varepsilon_0$: 29.5
Thermal Expansion Coefficients at 25 °C	‖a, 2.0 x 10^{-6}/K @ 25 °C ‖c, 2.2 x 10^{-6}/K @ 25 °C
Thermal Conductivity	38 W /m /K @ 25 °C

Transparency Range	420 - 5200 nm
Refractive Indices	n_e = 2.146, n_o = 2.220 @ 1300 nm n_e = 2.156, n_o = 2.322 @ 1064 nm n_e = 2.203, n_o = 2.286 @ 632.8 m
Optical Homogeneity	~ 5 x 10^{-5} /cm
Sellmeier Equations: (λ in μm)	$n_o^2(\lambda) = 4.9048+0.11768/(\lambda^2 - 0.04750) - 0.027169\,\lambda^2$ $n_e^2(\lambda) = 4.5820+0.099169/(\lambda^2 - 0.04443) - 0.021950\,\lambda^2$

NLO Coefficients	d_{33} = 34.4 pm/V, d_{31}= d_{15} = 5.95 pm/V, d_{22}= 3.07 pm/V
Electro-Optic Coefficients	γ^T_{33} = 32 pm/V, γ^S_{33} = 31 pm/V, γ^T_{31}= 10 pm/V, γ^S_{31} = 8.6 pm/V, γ^T_{22}= 6.8 pm/V, γ^S_{22}= 3.4 pm/V,
Half-Wave Voltage, DC Electrical field ‖z, light ⊥ z: Electrical field ‖x or y, light ‖ z:	 3.03 KV 4.02 KV
Damage Threshold	200 MW/cm^2 (10 ns)
Efficiency NLO Coefficients	d_{eff} = 5.7 pm/V or ~ 14.6 x d_{36} (KDP) for SHG@ 1300 nm; d_{eff} = 5.3 pm/V or ~ 13.6 x d_{36} (KDP) for OPO pumped at 1064 nm; d_{eff} = 17.6 pm/V or ~ 45 x d_{36} (KDP) for quasi-phase-matched structure

Birefringent Crystals

FOCtek provide a wide range of birefringent crystals: YVO_4, Calcite, α-BBO, $LiNbO_3$, quartz, etc. The crystals are widely used in the application of beam displacers, polarizing optics (Glan Laser, Glan Taylor, Glan Thompson, Wollaston and Rochon), optical isolators, circulators and interleaver, etc.

The comparation of refractive indices, birefringence, and walk off anlge for common crystals are listed below for reference. (Notes: ρ is walk off angle at crystal 45° cut)

YVO_4	1550nm:	n_o=1.9447	n_e=2.1486	Δn=0.2039	ρ=5.69°
Calcite:	1550nm:	n_o=1.6629	n_e=1.47722	Δn=-0.1564	ρ=-5.75°
α-BBO	1550nm:	n_o=1.64998	n_e=1.51199	Δn=-0.137996	ρ=-4.99°
$LiNbO_3$	1550nm:	n_o=2.21122	n_e=2.13806	Δn=-0.073156	ρ=-1.93°

Feature comparation of YVO_4, Calcite, α-BBO Birefringent crsytals

1) YVO_4 has better temperature stability and physical and mechnical properties than others.
2) Calcite is hard to obtain high optical quality because of its low susceptibility to moisture and low hardness, which make it easily scratched.
3) $LiNbO_3$ birefringence is smallest among them, although its mechanical and physical properties is similar to YVO_4.
4) α-BBO transparency range can cover far UV wavelength band from 189nm to 3500nm, it's especially Suitable for high power and UV polarizer application.

The main properties is listed follows

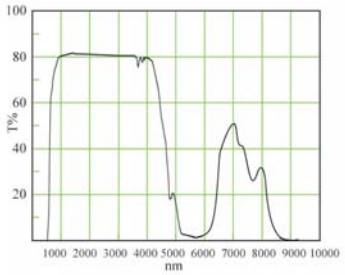
	YVO4	Calcite	α-BBO
Transparency	400—5000nm	350—2300nm	189—3500nm
Crystal class (Uniaxial)	Positive $n_o=n_a=n_b, n_e=n_c$	Negative $n_o=n_a=n_b, n_e=n_c$	Negative $n_o=n_a=n_b, n_e=n_c$
Mohs hardness	5	3	4.5
Thermal Expansion Coefficient	$\alpha_a=4.43\times10^{-6}$/k $\alpha_c=11.37\times10^{-6}$/k	$\alpha_a=24.39\times10^{-6}$/k $\alpha_c=5.68\times10^{-6}$/k	$\alpha_a=4\times10^{-6}$/k $\alpha_c=36\times10^{-6}$/k
Hygroscopic susceptibility	Non-Hygroscopic	Low to moisture	low

YVO_4

Undoped YVO_4 crystal is widely used in many beam displace applications because of its large birefringence. It also has good physical and favorable mechnical properties than others birefringent crystals, which make YVO_4 well suited for polarizer and compact fiber optical components, such as isolators, circulators and interleaver etc.

Capabilities:

1) Diameter:	max. 25mm
2) Length:	max. 30mm
3) Surface Quality:	better than 20/10 scratch/dig Per MIL-0-13830A
4) Beam Deviation:	<3 arc min
5) Optical Axis Orientation:	+/-0.20°
6) Flatness:	< λ/4 @633nm
7) Wavfront Distortion:	< λ/2 @633nm
8) Coating:	upon customer's Specification



Transmission VS wavelength

Physical and Optical Properties:

Transparency Range	400-5000nm
Crystal Symmetry	Zircon tetragonal,space group D4h
Crystal Cell	a=b=7.12Å;c=6.29Å
Density	4.22g/cm^3
Hygroscopic Susceptibility	Non-hygroscopic
Mohs Hardness	5 glass like
Thermal Optical Coefficient	$dn_a/dT=8.5x10^{-6}/K$; $dn_c/dT=3.0x10^{-6}/K$
Thermal Condutivity Coefficient	∥C: 5.23 w/m/k; ⊥C:5.10w/m/k
Crystal Class	Positive uniaxial with $n_o=n_a=n_b$, $n_e=n_c$
Refractive Indices Birefringence($\Delta n=n_e - n_o$) and Walk-Off angle at 45 deg(ρ)	n_o=1.9929, n_e=2.2154,Δn=0.2225, ρ=6.04°,at 630nm n_o=1.9500, n_e=2.1554,Δn=0.2054, ρ=5.72°,at 1300nm n_o=1.9447, n_e=2.1486,Δn=0.2039, ρ=5.69°,at 1550nm
Sellmeier equation (λ in μm)	$n_o^2 = 3.77834+0.069736/(\lambda^2-0.04724)-0.0108133\lambda^2$ $n_e^2 = 4.59909+0.110534/(\lambda^2-0.04813)-0.0122676\lambda^2$

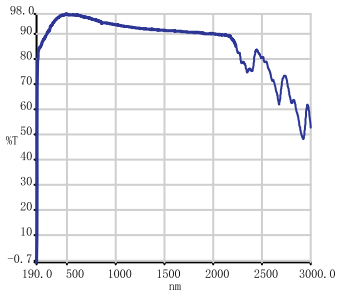
α-BBO

High temperature phase of BaB_2O_4 is an excellent birefringent crystal; it is characterized by large birefringent coefficient and wide transmission window from 189nm to 3500nm, particularly it is suitable to make the high power UV polarizer, due to its unique UV transparency and good mechanical properties.

The physical, chemical, thermal and optical properties of α-BBO crystals are similar to those of β-BBO, for instant high optical homogeneity extremely low absorption in the UV to IR range , low hygroscopic susceptibility, high damage threshold.

Capabilities:

1) Diameter: max 40~50mm
2) Length: max 25~35mm
3) Surface quality: better than 20/10
4) Beam deviation: < 3 arc min
5) Optical axis orientation: +/-0.50
6) Flatness: < λ/4 @633nm
7) wavefront distortion: <λ/2 @633nm
8) Coating: upon customer's specification



Transmission VS Wavelength

Physical and Optical Properties:

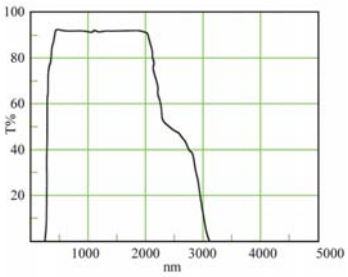
Transparency Range	189~3500nm
Density	3.85g/cm^3
Therm-Optic Coefficients	dn_o/dT=-9.3x10^{-6}/°C dn_e/dT=-16.6x10^{-6}/°C
Optical Homogeneity	Δn ≈10^{-6}/cm
Mohs Hardness	4.5 glass like
Damage Threshold	1GW/cm^{2}at 1064nm 200MW/cm^2 at 532nm
Thermal Expansion Coefficients (25°C~900°C)	α_a=4x10^{-6}/K α_c=36x10^{-6}/K
Linear Absorption Coefficients	a<0.005cm^{-1}from 300nm to 2300nm
Refractive Indices Birefringence(Δn=n_e - n_o) and Walk-Off angle at 45°C(ρ)	n_e= 1.53797, n_o=1.65790, Δn=- 0.11993, ρ=-4.9532°,at 1064nm n_e= 1.55345 , n_o=1.67755, Δn=- 0.12411, ρ=-5.0407°,at 532nm n_e= 1.61145 , n_o=1.76171, Δn=- 0.15026, ρ=-5.6926°,at 266nm
Sellmeier equation (λ in μm)	n_o^2 = 2.7471+0.01878/(λ^2-0.01822)-0.01354λ^2 n_e^2 = 2.37153+0.01224/(λ^2 -0.01667)-0.01516λ^2

Calcite

Calcite is a natural crystal that has high birefringence, wide spectral transmission and availability in reasonably sized rhombs. It's a negative uniaxial crystals and mostly used as visible and near IR polarizers.

Capabilities:

1) Diameter: max 30~40mm
2) Length: max 25~35mm
3) Surface Quality: better than 40/20 scratch/dig
4) Beam Deviation: < 3 arc minutes
5) Optical Axis Orientation: +/-0.50
6) Flatness: < λ/4 @633nm
7) Wavefront Distortion: < λ/2 @633nm
8) Coating: upon customer's Specification



Transmission Vs Wavelength

Notes:

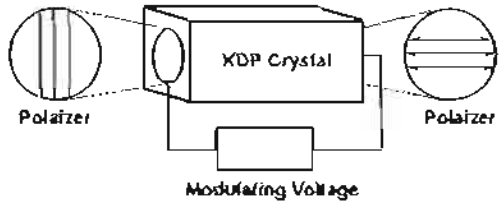
As the susceptibility to moisture is low so that , it's difficult to achieve excellent optical quality due to low hardness.

Physical and Optical Properties:

Transparency Range	350~2300nm
Partical Shape	Crystalline rhombihedral
Density	2.7 g/cm^3
Hygroscopic Susceptibility	Low susceptibility to moisture
Mohs Hardness	3
Thermal Expansion Coefficient	α_a=24.39 x 10^{-6}/k; α_c=5.68 x 10^{-6}/k
Crystal Class	Negative uniaxial with $n_o=n_a=n_b$, $n_e=n_c$
Refractive Indices Birefringence($\Delta n=n_e - n_o$) and Walk-Off angle at 45°C(ρ)	n_o=1.6557, n_e=1.4852 Δn=-0.1705, ρ=6.20° @630nm
	n_o=1.6380, n_e=1.4783 Δn=-0.1596, ρ=5.83° @1300nm
Sellmeier equation	$n_o^2 = 2.69705+0.0192064/(\lambda^2-0.01820)-0.0151624\lambda^2$ $n_e^2 = 2.18438+0.0087309/(\lambda^2-0.01018)-0.0024411\lambda^2$

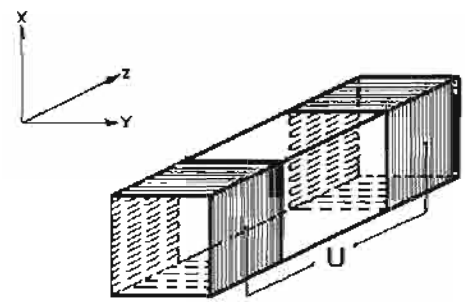
Electro-optic effect is the change in the refractive index resulting from the appliation of a DC or low frequency electric field. A field applied to an ansotropic electro-optic material can modify its refractive indices and thereby its effect on polarized light. The dependence of the refractive index on the applied electric field takes two forms: linear electro-optic effect, and quadratic electro-optic. Electro optics crsyals can be used for producing controllable optical devices such as Q-switch application.

If a linearly polarized light passes through an E-O crystal, the phase retardation (Γ) will be induced by Δn to $\Gamma = 2\pi\Delta nL$, where L is crystal length, for KD*P, as an example, $\Delta n=0.5 n_o^3 r_{63} E/\lambda$, $\Gamma = \pi L n_o^3 r_{63} E/\lambda$. It is clear that the phase of light will change together with electric field (E). This is called electro-optic phase modulation. If two crossed polarizers are placed at input and output ends of E-O crystal separately as shown in (Amplitude Modulator), the output intensity of light will be $I = I_0 \sin^2(G/2)$, where I_0 is input intensity. That means the intensity or amplitude of light can also be modulated by electric field. This is called amplitude modulation.

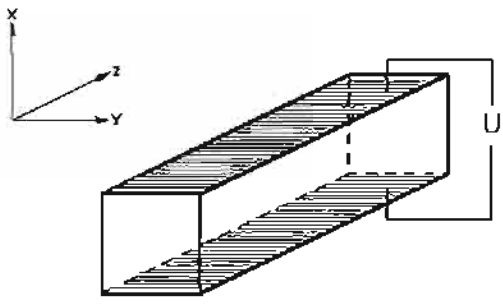


Amplitude Modulator

There are two kinds of E-O modulations. One is longitudinal E-O modulation if the directions of electric field and light propagation are the same (as shown in Longitudinal Modulation). The KDP isomorphic crystals are normally used in this scheme. If the directions of electric field and light propagation are perpendicular, it is called transverse E-O modulation (see Transverse Modulation). The $LiNbO_3$, $MgO:LiNbO_3$, $ZnO:LiNbO_3$, BBO and KTP crystals are usually employed in this scheme.



Longitudinal Modulation



Transverse Modulation

The half-wave voltage (V_π) is defined as the voltage which makes $\Gamma = \pi$, for example, $V_\pi=\lambda/(2n^3r_{63})$ for KD*P and $V_\pi=\lambda d/(2nr22L)$ for $LiNbO_3$, where λ is light wavelength and d is the distance between the electrodes.

FOCtek provide four kinds of electro-optic crystal BBO, KTP, $LiNbO_3$, $LiTaO_3$ with z-cut, AR coating, and Au-electrodes.

BBO

BBO crystals with Z-cut is an excellent electro-optic crystal combining good physical properties, it's suitable for high power applications. It launchs a super Q-switch for a cw diode pumped Nd:YAG laser with average power >50W. Please refer to Page 93 for more information about BBO crystal.

We can provide as large as 6x6x25mm BBO for high power aplication. The standard BBO for Q-Switch as:

Part No.	Size (mm)	Orientation	Coating
BBO101	3x3x18	Z-Cut	Z-face AR coating, X-face Au coating
BBO102	3x3x20	Z-Cut	Z-face AR coating, X-face Au coating

■Please contact us for Quotation of volume quantity

KTP

KTP has promising E-O and dielectric properties comparable to those of LiNbO3, which makes it extremely useful to various E-O devices. The following table gives the comparison of KTP and those crystals commonly used E-O modulator materials:

Material			Phase			Amplitude		
	ε	n	r pm/V	k 10^{-6}/°C	$n^7 r^2/\varepsilon$ $(pm/V)^2$	r pm/V	k 10^{-6}/°C	$n^7 r^2/\varepsilon$ $(pm/V)^2$
KTP	15.4	1.80	35.0	31	6130	27.0	11.7	3650
LiNbO3	27.9	2.20	31.0	82	7410	20.1	42	3500
KD*P	48.0	1.47	26.4	9	178	24.0	8	178
LilO3	5.9	1.74	6.4	24	335	1.2	15	124

When these properties are combined with high damage threshold, low optical loss at high average power, wide optical bandwidth, thermal and mechanical stability, KTP crystals are expected to replace $LiNbO_3$ crystals as E-O modulators, especially for mode-locking diode laser pumped Nd:YAG and Nd:YLF lasers as well as Ti:Sapphire and Cr:$LiSrAlF_6$ lasers.

PART 5

OPTICAL COATING

COATING CENTER

Total 10 Coaters, including three Optorun Coaters and one Lebold Coater

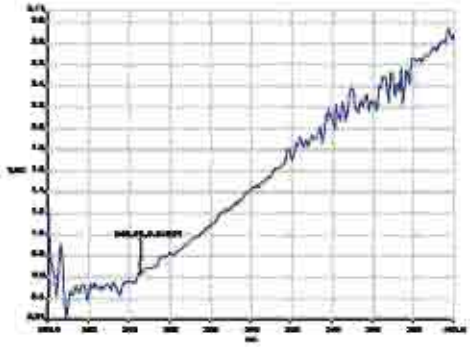
COATED OPTICAL COMPONENTS

The Coating on the optical element is very important, which can improve the transmission, high reflection, etc. Foctek offers all kinds of anti-reflective (AR) coating, BBAR, V-coating, Dual Wavelength AR coating, high reflective (HR) coating, partial reflective (PR) coating, filter coating, dichroic coating, polarization beamsplitter coating and metal reflective coating, etc. according to customers' requirement. Foctek has the strong capability in coating design, we supply the coating design services for your special coating requirement.

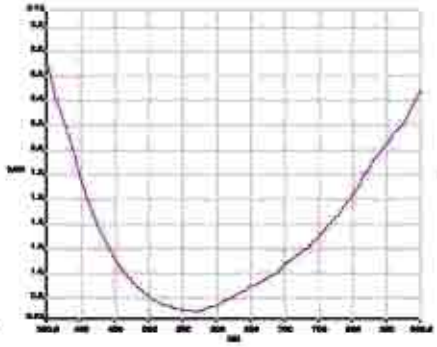
Foctek owns 10 coaters, which provide large coating capacity for our optical components. we measure the coating spectral curves of our coating products by Lambda 950(UV/VIS/NIR) spectrophotometer. The coating spectral curves measured by Lambda 950 can be provided with the delivery upon your request. The adhesion and hardness of the coatings are tested according to the Standard Mil Spec tests of Abrasion (Mil-C-675A), Adhesion (Mil-M-13508C), Hardness(MIL-M-13508C).

Anti reflection Coating

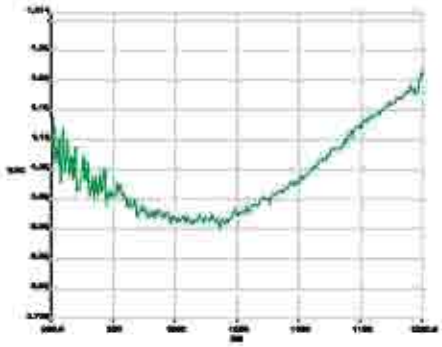
Single Layer MgF_2 AR Coating



Single layer MgF_2@245 nm

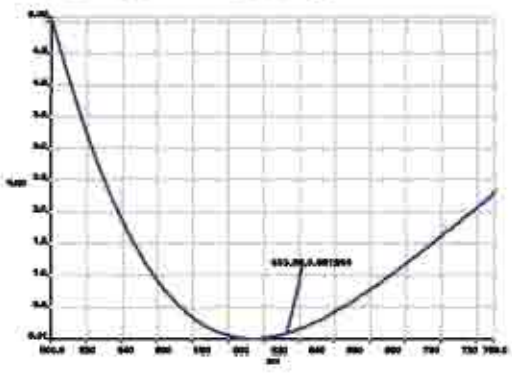


Single layer MgF_2@532 nm

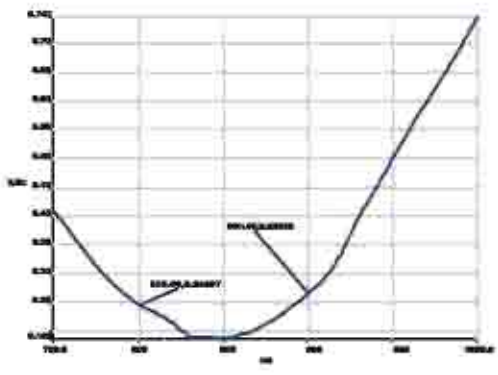


Single layer MgF_2@1064 nm

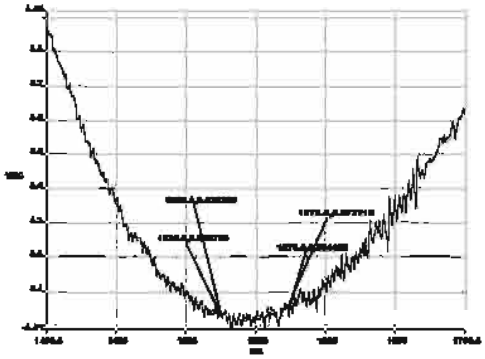
Multi-layer AR Coating



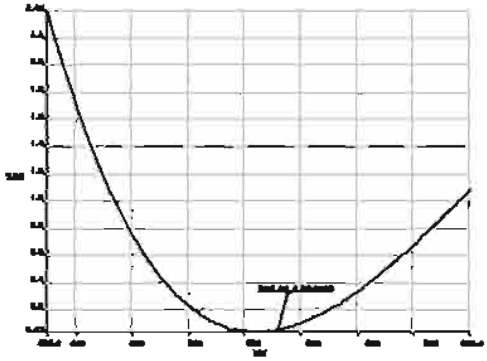
AR@633nm



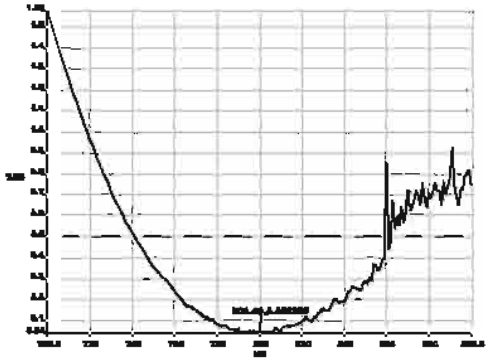
AR coating @ 850+/-50 nm, R<0.3%



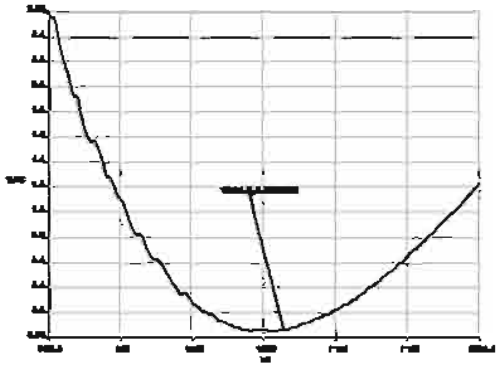
AR@1550±50 nm



AR@532 nm

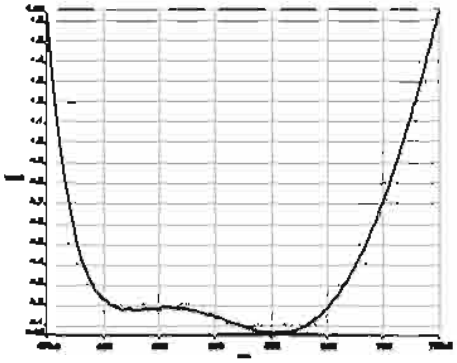


AR@800nm

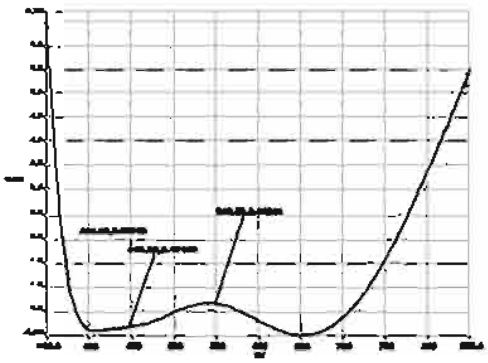


AR@1064 nm

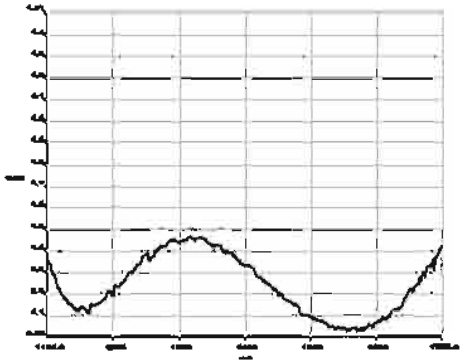
Broadband Multi-layer AR Coating

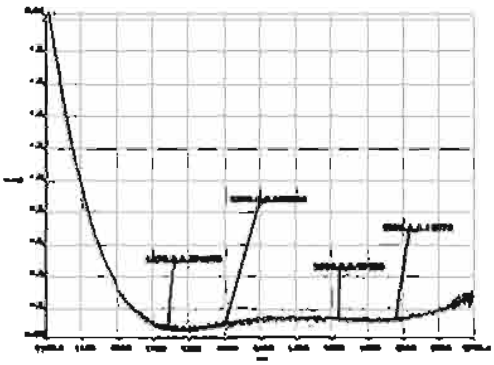


AR@450-650 nm Ravg<0.5%

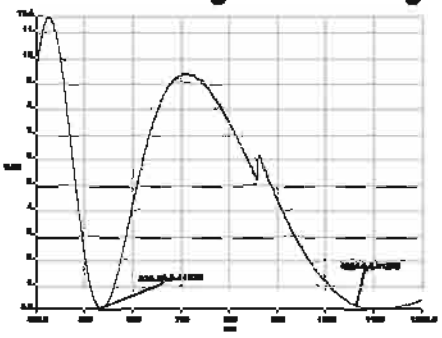


AR coating @ 400-700 nm

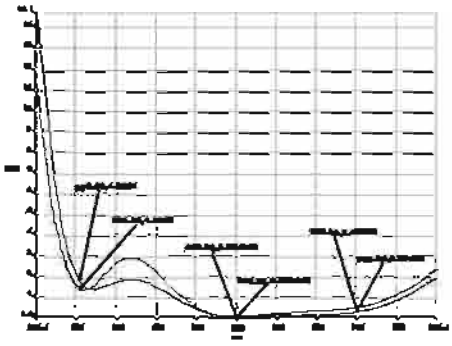




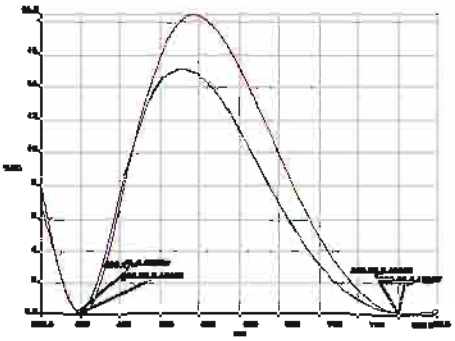
Dual Wavelength AR Coating



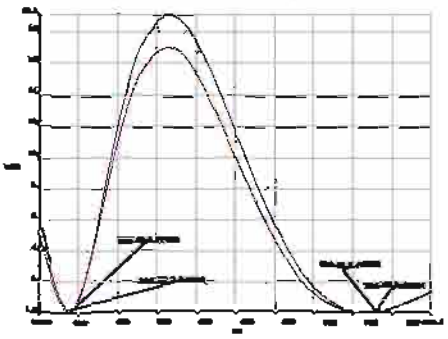
AR@1064&532 nm



AR@355nm,& AR@550~700nm

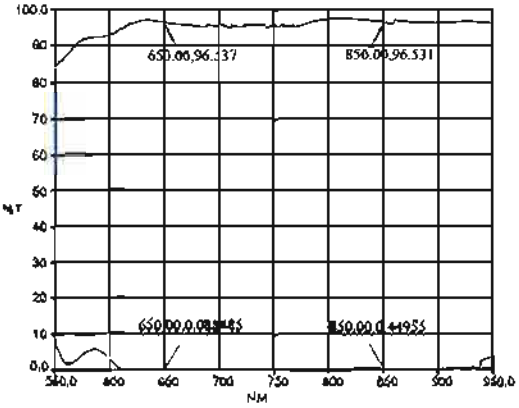


AR@800 & 400 nm

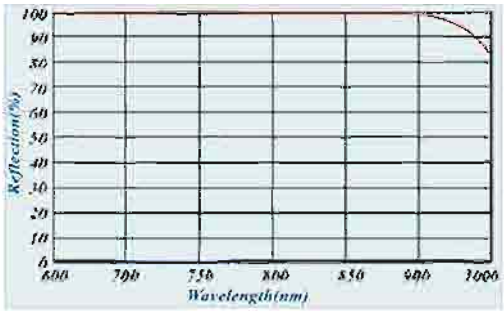


AR@780 & 390 nm

Polarization Beam splitter Coating

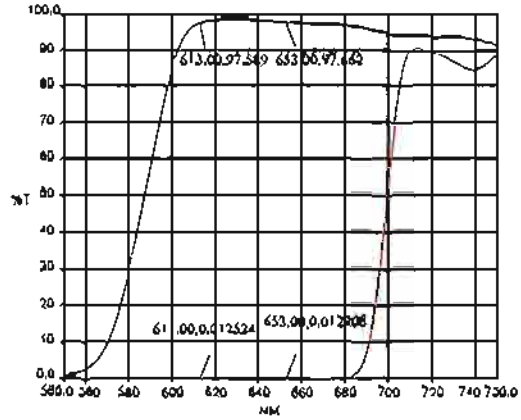


Tp>95%,Ts<1% @ 650-850nm

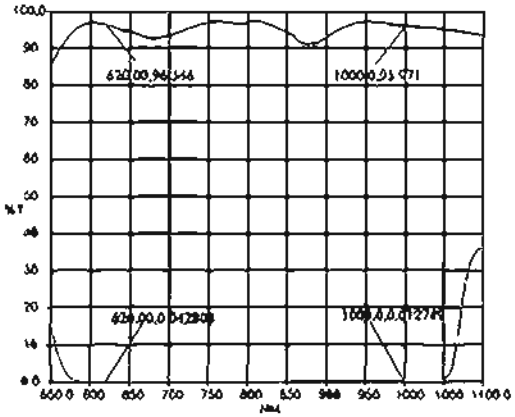


Rs>99%,Rp<5% @650-850nm

High Extinction PBS Coating



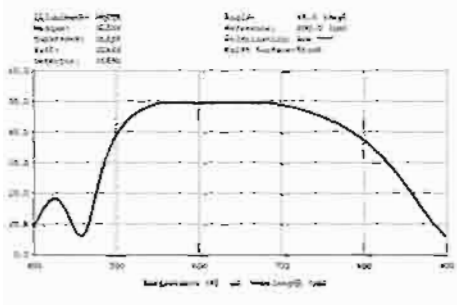
Tp>96%,Tp:Ts>3000:1 @ 633±20nm



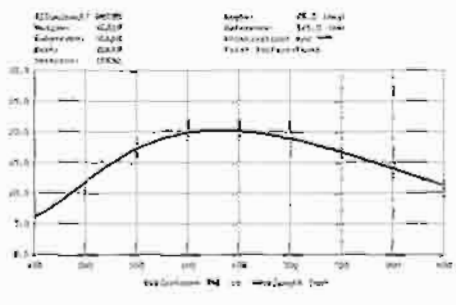
Tp>90%,Tp:Ts>1000:1 @ 820 -1000nm

Partial Reflection Coating

Single Wavelength Band PR Coating

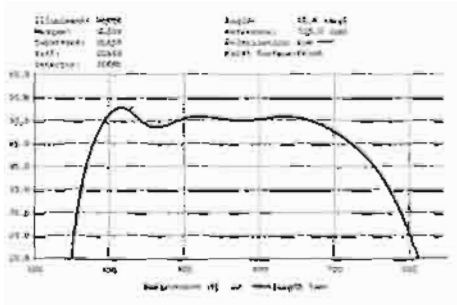


PR@633 nm, R/T=50%/50%±2%

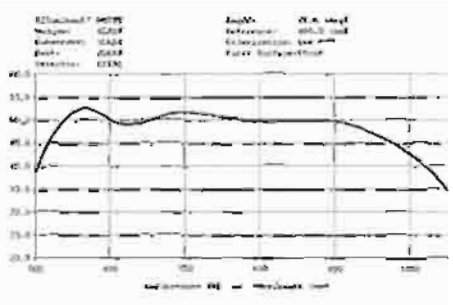


PR@633 nm, R/T=20%/80%±2%

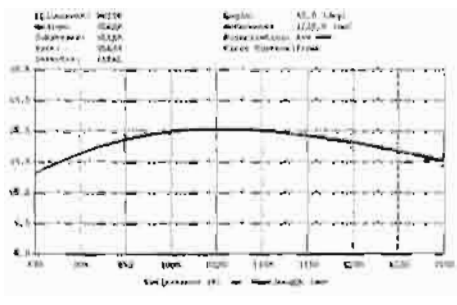
Broadband PR Coating



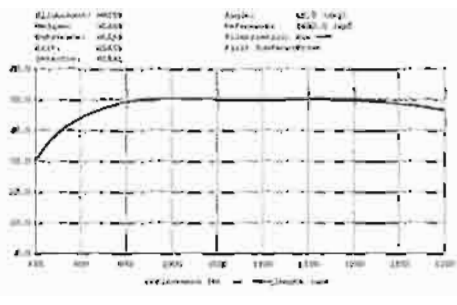
PR@ 400-700nm, R/T=50%/50%±5%



PR@ 600-900nm, R/T=50%/50%±5%



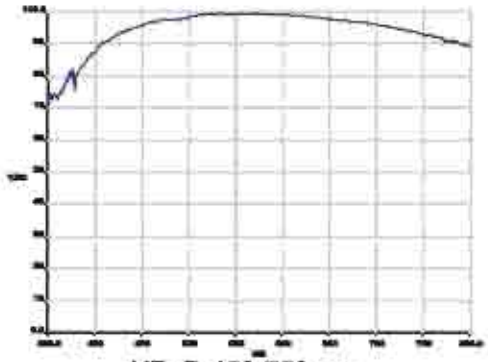
PR@ 900-1200nm, R/T=20%/80%±5%



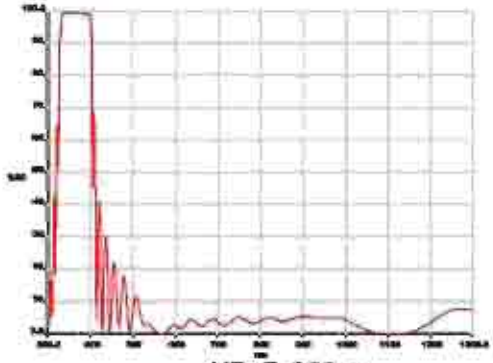
PR@ 950-1250nm, R/T=50%/50%±5%

High Reflection Coating

Dielectric High Reflective Coating

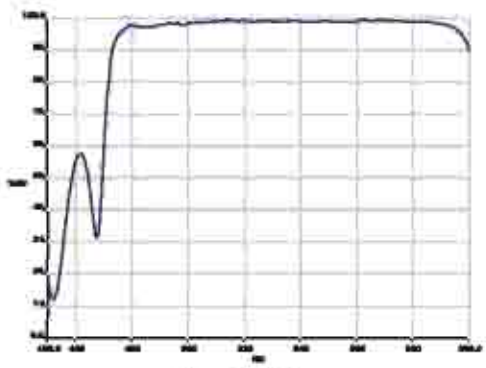


HR @ 450-750 nm



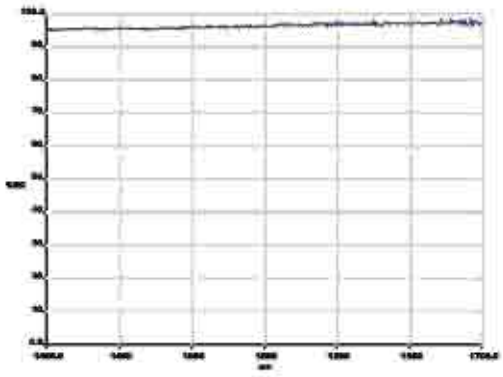
HR @ 355nm

HR @ 1000-1200 nm

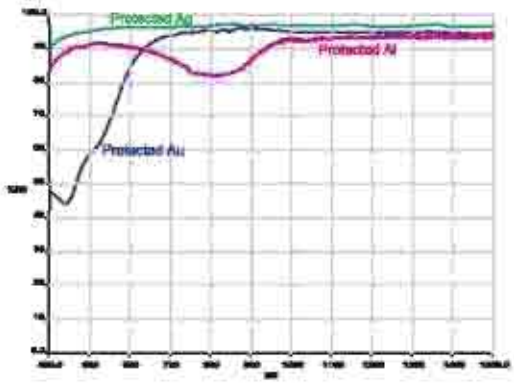


HR @ 532 nm

Metallic High Reflective Coating

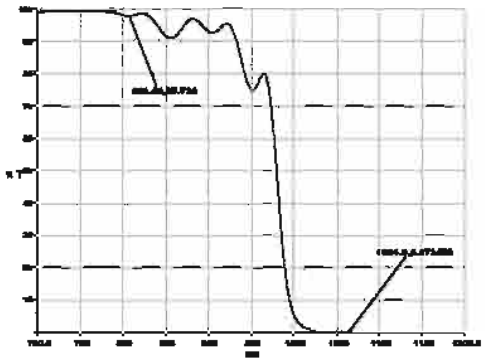


Protected Ag @ 1400-1700

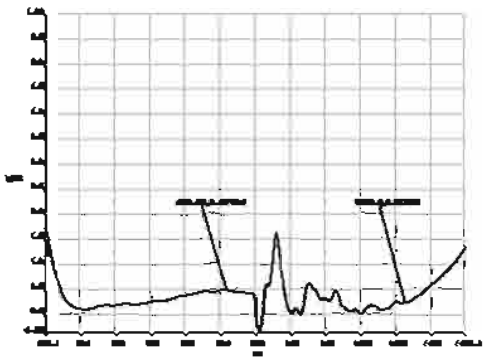


Protected Ag
Protected Au
Protected Al

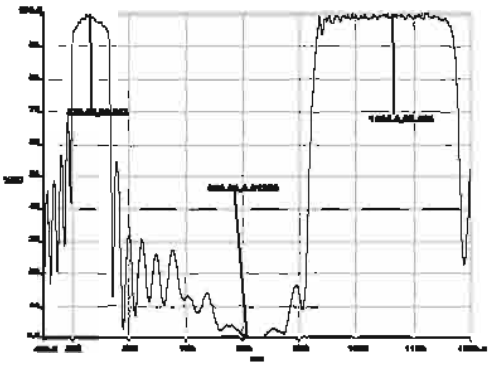
Diode Pumped Laser Optics Coatings



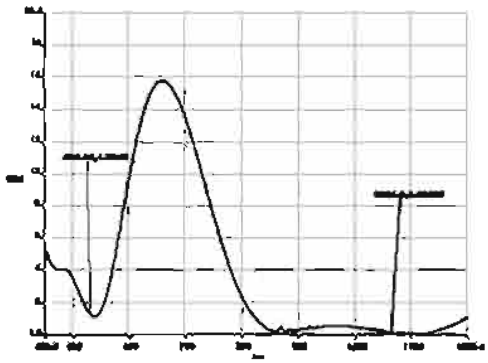
HR@1064 & HT@808 nm



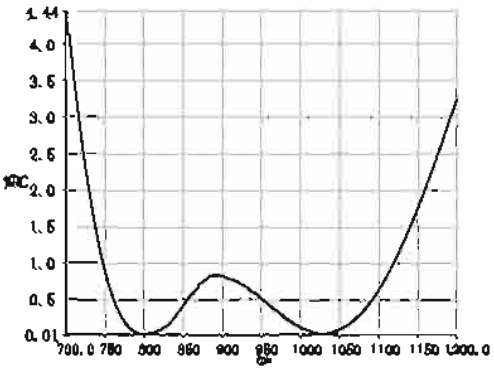
AR@1064 & HT@808 nm



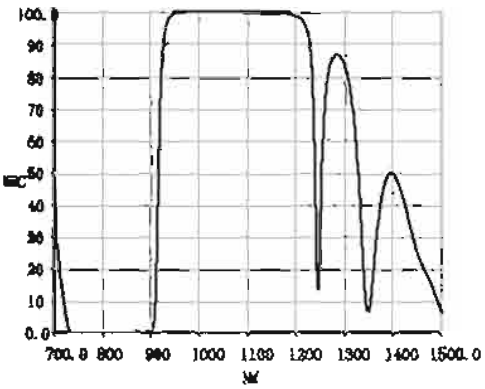
HR@ 1064&532 nm, HT@808 nm



AR@ 1064&HT@808&532 nm



AR@ 1064 nm&HT@808 nm



HR@ 1064 nm&HT@808 nm

PART 6

Holder

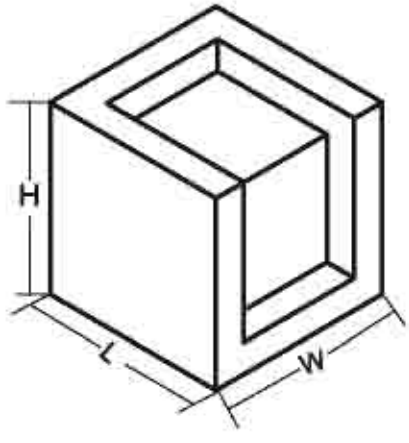
Cube Beamsplitter Holder

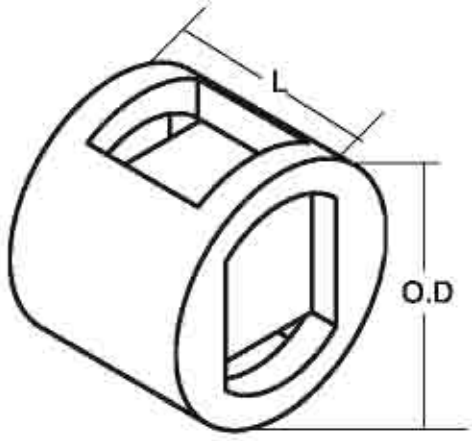
Quadrate Shape

P/N#	Cube Prism Size	W$^{+0}_{-0.2}$ (nm)	H$^{+0}_{-0.2}$ (nm)	L$^{+0}_{-0.2}$ (nm)	Unit Price
MCB1010	10.0×10.0×10.0	25.4	25.4	25.4	$15.0
MCB1012	12.7×12.7×12.7	25.4	25.4	25.4	$15.0
MCB1015	15.0×15.0×15.0	25.4	25.4	25.4	$15.0
MCB1020	20.0×20.0×20.0	30.0	30.0	30.0	$15.0
MCB1025	25.4×25.4×25.4	38.0	38.0	38.0	$15.0

Round Shape

P/N#	Cube Prism Size	O.D$^{+0}_{-0.2}$ (nm)	L$^{+0}_{-0.2}$ (nm)	Unit Price
MCB2010	10.0×10.0×10.0	Φ25.4	20.0	$15.0
MCB2012	12.7×12.7×12.7	Φ25.4	20.0	$15.0
MCB2015	15.0×15.0×15.0	Φ30.0	25.0	$15.0
MCB2020	20.0×20.0×20.0	Φ38.0	30.0	$15.0
MCB2025	25.4×25.4×25.4	Φ43.0	38.0	$15.0





Waveplate Holder

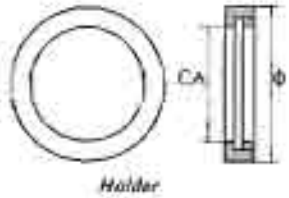
Ring Holder

Specifications:

Material: Black anodized aluminum

Diameter tolerance: +/-0.1mm

Thickness tolerance: +/-0.1mm



Holder

P/N#	ϕ (mm)	T (mm)	Aperture (mm)	CA (mm)	Unit Price
WH1508	15.0	6.0	8.0	7.0	$9.9
WH2508	25.4	6.0	8.0	7.0	$9.9
WH2510	25.4	6.0	10.0	9.0	$9.9
WH2512	25.4	6.0	12.7	11.5	$9.9
WH2515	25.4	6.0	15.0	13.5	$9.9
WH2520	25.4	6.0	20.0	18.5	$9.9
WH3015	30.0	6.0	15.0	13.5	$9.9
WH3020	30.0	6.0	20.0	18.0	$9.9
WH3025	30.0	6.0	25.4	22.8	$9.9

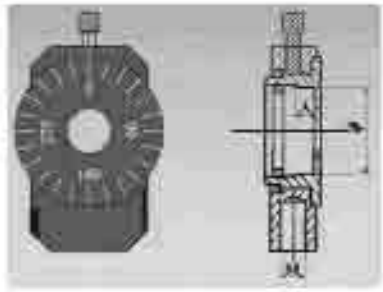
Rotating Holder

Specifications:

Material: Black anodized aluminum

Rotation tolerance: <5°

Diameter tolerance: +/-0.1mm



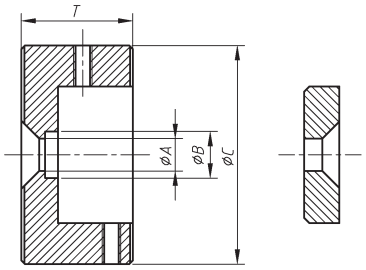
P/N#	Width (mm)	Height (mm)	Length (mm)	Diameter (ring holder)	Thickness (ring holder)	Unit Price
WRH25	40.0	60.0	10.0	25.4 mm	6.0~8.0 mm	$38
WRH30	45.0	63.0	10.0	30.0 mm	6.0~8.0 mm	$43

Note: To use the rosting holder, you should hold the waveplate in a ring holder first.

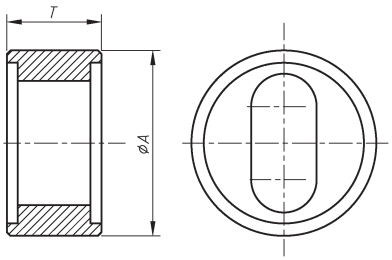
Crystal Holder

In order to prevent crystals from damaging or to be easily operated, FOCtek provide four kinds of mount of holder to install different dimension crystals. Please contact our sales for more information.

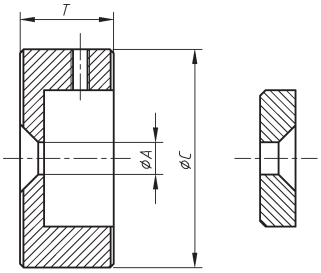
ΦC(mm)	T (mm)	Part No.	Crystal Aperture (mm)	Crystal Length (mm)	Unit Price
25.4	5.0	BH2001	4x4 - 10x10	0.1 - 2	$10.0
25.4	9.5	BH2002A	4x4 - 10x10	4 - 6	$10.0
25.4	9.5	BH2003	8x8 - 10x10	2 – 4	$10.0
25.4	13.5	BH2002B	4x4 - 10x10	6-10	$10.0



BH2001



BH2002A/BH2002B



BH2003

Note:

Delivery Time: 2 Weeks ARO(Typical)