



福州杰益斯光电有限公司  
**Fuzhou JYS Optronics Co., Ltd**



JYS Optonics located in Fuzhou Fujian Province, a beautiful coast city of South in China. As a professional manufacturer of optical components and crystal components, JYS Optonics supplies high quality components including waveplates, laser mirrors, laser windows, optical windows, filters, mirrors, beamsplitters, prisms, lenses, laser crystal(Nd:YVO4,Nd:YAG),NLO Crystal(BBO,LBO,KTP,etc) and Diode Pumped Laser Crystal Microchip etc. The main application are include Laser ,Electronics, Survey, Graphic, Medical instruments, Research, etc.

JYS Optonics has a complete optical production line. We are specialist in the capability of Precision Polishing, Doublet Side polishing and Iron Assisted Vacuum Deposition coating technology. The quality control laboratory utilizes test equipments such as thickness meter, Pe Lambda-750 spectrophotometer, interferometer, Goniometer, and waveplate inspector among others those are operated by our internal highly qualified staff.

JYS Optonics engineers have more than 10 years of rich experiences to fabricate many optical and crystal components, and continually innovate to reach a new and higher level. Our quality system is according to ISO9001:2008 to control and our staff know well about ISO10110,US Military standard and DIN. Our commitment is to continuously offer our customers the highest performance optical and crystal solutions with on time delivery and a competitive price.

JYS Optonics has owned great reputation and developing opportunities while cooperating closely with global customers during the past years. Fully understand customer's demand and truly solve their requirement is JYS service philosophy.

JYS dedicate to supply excellence products, great service and technical support to offer customers one-stop shopping.







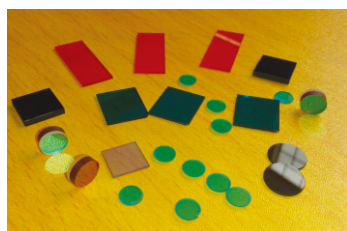
Waveplates  
Low order  
Zero order  
Multi-order  
Dual wavelength  
True Zero order  
Achromatic

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Window  
Si window  
Ge window  
CaF2 window  
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Sapphire window

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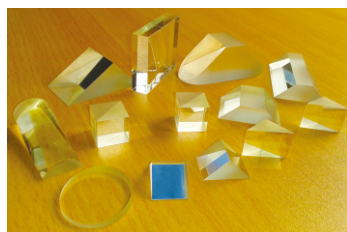
Filters  
Color Filters  
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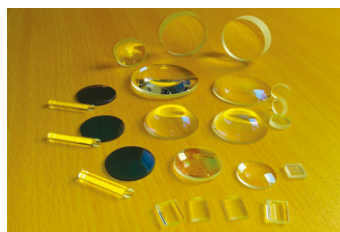
Mirror  
Beamsplitter

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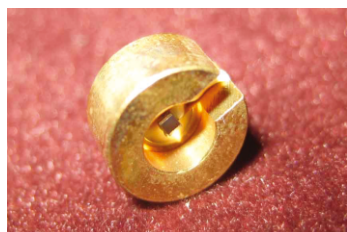
Prism  
Right angle prism  
Penta prism  
Dove prism  
Roof prism  
Corner cube prism  
Wedge Prism  
Anamorphic Prism  
Polarizer

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Normal Lenses  
PCX,PCV  
BCX,BCV  
Meniscus  
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Cylindrical Lenses

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Laser crystal  
NLO crystal

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Coatings  
AR  
HR  
Metal etc.

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JYS fabricate optical components with various optical materials. The most common materials

We have processed are:

**General optical glass:** Schott glass, Ohara glass, China local glass

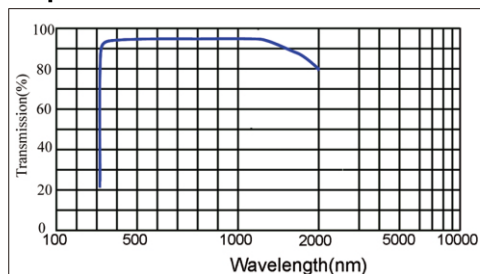
**Special glass:** UV grade fused silica, Color glass, Float glass, etc.

**Optical crystal:** Quartz, Sapphire, Silicon, Germanium,  $\text{MgF}_2$ ,  $\text{CaF}_2$ , etc.

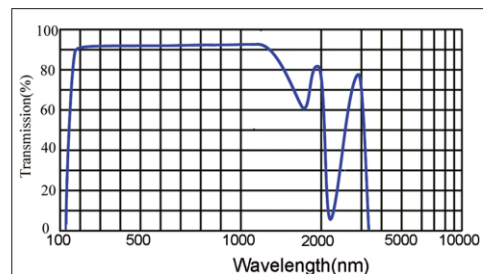
## Material Parameters

Materials	Refractive Index	Transmission Range(um)	Thermal Expansion Coefficient( $10^{-6}/\text{K}$ )
BK7	1.5168(588nm)	0.330 - 2.1	7.1
SF11	1.78472(588nm)	0.370 - 2.5	6.1
Fused Silica	1.45846(588nm)	0.185 - 2.5	0.50
Sapphire	1.755(1.0um)	0.180 - 4.5	8.4
Silicon	3.4179(10um)	1.200 - 7.0	2.23
Germanium	4.003(10um)	1.900 - 16	5.7
Quartz	$n_o=1.5427$ $n_e=1.5518$ (633nm)	0.200 - 2.3	6.88  c; 12.38  a
$\text{CaF}_2$	1.399(5.0um)	0.170 - 7.8	18.85
$\text{MgF}_2$	$n_o=1.3836$ $n_e=1.3957$ (405nm)	0.130 - 7.0	8.8  c; 13.1  a
$\text{CaCO}_3$ (Calcite)	$n_o=1.6557$ $n_e=1.4852$ (633nm)	0.210 - 2.3	24.39  c; 5.68  a

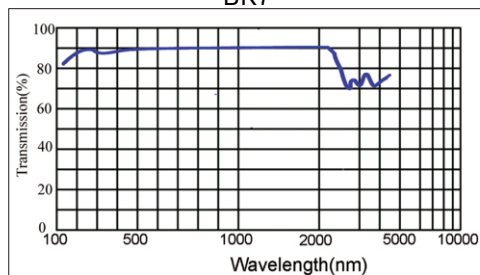
## Sample transmission curves:



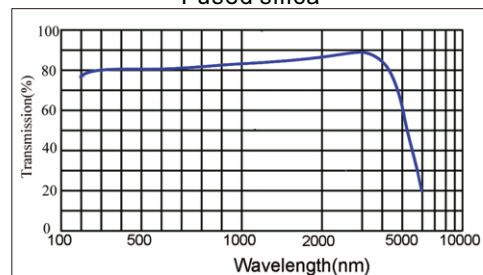
BK7



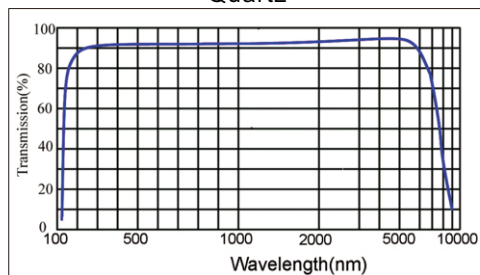
Fused silica



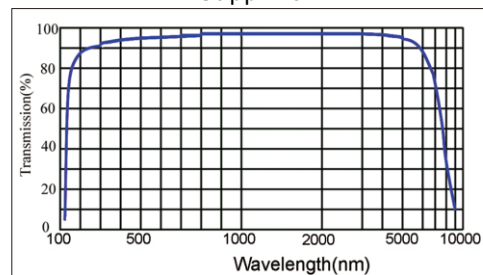
Quartz



Sapphire



$\text{CaF}_2$



$\text{MgF}_2$



## Waveplates

Waveplates (retardation plates or phase shifters) are made from materials which exhibit birefringence. The velocities of the extraordinary and ordinary rays through the birefringent material varies inversely with their refractive indices. This difference in velocities gives rise to a phase difference when the two beams recombine. In the case of an incident linearly polarized beam this is  $a = 2\pi d(n_e - n_o)/\lambda$ , where  $a$  is phase difference;  $d$  is thickness of waveplate;  $n_e, n_o$ , are refractive indices of extraordinary and ordinary rays respectively;  $\lambda$  is wavelength. At any specific wavelength the phase difference is governed by the thickness of the retarder.

### Waveplate Type

- ✦ Low Order Waveplate
- ✦ Zero Order Waveplate
- ✦ Multi-Order Waveplate
- ✦ Dual Wavelength Waveplate
- ✦ True Zero Order Waveplate
- ✦ Achromatic Waveplate

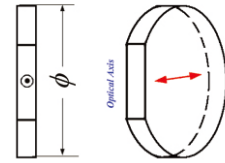


### Specifications:

Material:.....Crystal Quartz, MgF2  
 Dimension Tolerance:.....+0.0, -0.13mm, up to +/-0.02mm  
 Wavefront Distortion:..... $\lambda/8$  or  $\lambda/10$  @ 632.8nm  
 Retardation:..... $\lambda/8$ ,  $\lambda/4$ ,  $\lambda/2$ , or (typical) Retardation  
 Tolerance:.....up to  $\lambda/500$   
 Thickness:.....determine by retardation  
 Wavelength Range:.....240-2100nm  
 Parallelism:.....<1 arc second  
 Surface Quality:.....20-10 or 40-20 scratch and dig  
 AR/AR coating R<0.2% per face is available upon request.  
 Other retardations are also available

## ★ Low Order Waveplate

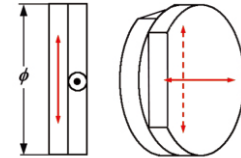
Low Order Waveplate include order from 1 to 6, and the thickness is always around 0.12 to 0.5mm. Though Low Order waveplate is more sensitive to wavelength compared to Zero Order waveplate, it has good temperature bandwidth and competitive price which make it a good choice



## ★ Zero Order Waveplate

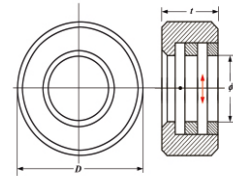
### UV Cemented or optical contacted Zero Order Waveplate

Cemented zero order waveplate is constructed by two quartz plates with their fast axis crossed. The two plates are cemented by UV epoxy or optically contacted. The difference in thickness between the two plates determines the retardance.



### Air Spaced Zero Order Waveplate

Air Spaced zero order waveplate is constructed by two quartz plates with their fast axis crossed, installing in a mount to form air gap between the two quartz plates. The difference in thickness between the two plates determines the retardance.



## ★ Multi-Order Waveplate

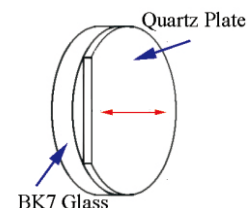
Multi-order waveplate includes order from 6 to 12, and the thickness is always around 0.5mm to 1.0mm. Compared with low order waveplate, Multi-order waveplates is more sensitive to wavelength and temperature changes. However, they are less expensive.

## ★ Dual Wavelength Waveplate

This waveplates is a special kind of multi order waveplates, which is designed to be used in dual wavelength setups. It's always used to manage the states of polarization of laser beams to obtain maximum conversion efficiency. The thickness is usually less than 2 mm.

## ★ True Zero Order Waveplate

The true zero-order waveplate means that the thickness of waveplate is very thin (less than 0.1mm) which make the true zero-order waveplate excellent in temperature, wavelength and incident angle (about 20°) bandwidth. Therefore, it is excellent choice for the highly accurate application. It is cemented with a block of glass which is limited to low and medium power application.



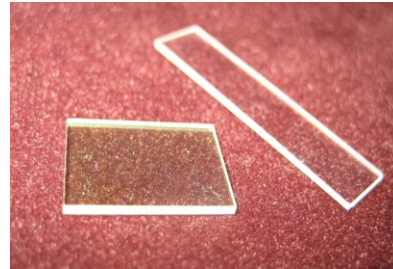
## ★ Achromatic Waveplate

This Achromatic waveplates is made from different birefringent crystal. Since the dispersion of the birefringence of two materials is different, it is possible to specify the retardation values at a broad wavelength range. So it can be used at a broadband wavelength range. These waveplates are not sensitive to temperature.

JYS developed Achromatic waveplate set which consists of 3-4 specific low order crystal quartz waveplates. Their fast axes cross at specific angle. Epoxy cemented and optically contacted is available.

## Windows

Windows are applied to isolate different physical environments while allowing light to pass. When selecting windows you should consider materials, transmission, scattering, wavefront distortion, parallelism and resistance to certain environment. JYS offers a wide range of different materials and different degree of precision windows



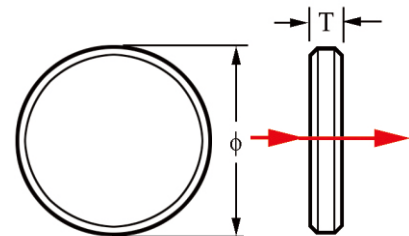
Material: BK7 and Fused Silica typically. Other glasses are available upon request.

### Commercial Quality Flat Windows

Non-precision windows commonly used for sight glasses, instrument windows, beamsplitter substrates, vacuum windows, etc.

#### Specifications:

Dimension Tolerance:.....+0.0,-0.2mm  
Thickness Tolerance:.....+/-0.1mm  
Clear Aperture:.....>85%  
Parallelism:.....1arc minute  
Surface Quality:..60-40 or 40-20scratch and dig  
Wavefront Distortion:..... $\lambda/4$  per inch  
Protective bevel



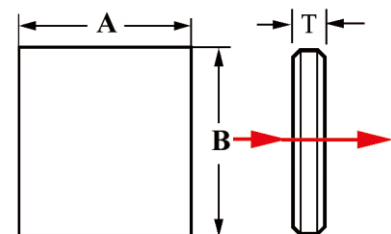
Circle Window

### High Precision Flat Windows

Ideal for interferometer flats, laser windows, beamsplitter substrates, or parallel plates, etc.

#### Specifications:

Dimension Tolerance:.....+0.0,-0.1mm  
Thickness Tolerance:.....+/-0.01mm  
Clear Aperture:.....>85%  
Parallelism:.....up to 5"  
Surface Quality:.....10-5 scratch and dig  
Wavefront Distortion:..... $\lambda/10$  per inch  
Protective bevel



Rectangle Window



## Sapphire Window

Sapphire has extreme surface hardness, highly thermal conductivity, high dielectric constant and resistance to common chemical acids and alkalis. Windows made from sapphire are ideal for demanding applications. JYS supplies double sides fine polished sapphire windows.

AR coating is available by request.

### Specifications:

Material:.....Sapphire crystal ( $\text{Al}_2\text{O}_3$ )  
Orientation:.....Random  
Dimension:.....2mm~150mm  
Surface Quality: .....60-40 scratch and dig  
Flatness:..... $\lambda/2@632.8\text{nm}$   
Parallelism:.....< 3 arc minutes  
Protective Bevel



## Magnesium Fluoride ( $\text{MgF}_2$ ) Window

$\text{MgF}_2$  material can be used for wide spectrum range from 120 to 7000nm. It is commonly used in thermal imaging and excimer laser applications.

### Specifications:

Material:.....Magnesium Fluoride Single crystal  
Dimension:dia.25.4(+0/-0.2)x3(+/-0.2)mm (typical)  
Surface Quality: .....40-20 scratch and dig  
Flatness:..... $\lambda/2@632.8\text{nm}$   
Parallelism:.....< 3 arc minutes  
Protective Bevel

## Silicon Window

Silicon (Si) is a popular and useful IR material. It has good transmission from 3 $\mu\text{m}$  to 5 $\mu\text{m}$ . It is widely used in IR sensors, thermal image, medical, and optical measurement systems

### Specifications:

Material:.....Optical grade single crystal silicon  
Dimension:dia.25.4(+0/-0.2)x3(+/-0.2)mm (typical)  
Surface Quality: .....40-20 scratch and dig  
Flatness:..... $\lambda/2@632.8\text{nm}$   
Parallelism:.....< 3 arc minutes  
Protective Bevel

Other window materials: Calcium Fluoride ( $\text{CaF}_2$ ), Germanium (Ge), Float glass, B270, Borofloat, etc.

## Colored Glass filters

Absorption filters may be neutral or spectrally selective. While spectral characteristics are customarily shown for a 1 mm thickness, the filters themselves are usually made thicker to minimize transmission differences caused by small variations in thickness occurring in manufacture.



### Specifications:

Material: ..... China local colored glass (Typical)  
Dimension: ..... Custom designed, up to 200mm  
Dimension tolerance: ..... 0.1mm  
Surface quality: ..... 60-40 scratch and dig  
Flatness: .....  $\lambda/4$  @632.8nm per inch  
Parallelism: ..... < 1 arc minute  
Protective Bevel

### Cut off Type Glass

Ultraviolet Glasses	Golden (Yellow) Glasses	Orange Glass
Red Glass	Infrared Glass	

### Selective Absorption Type Glass

Ultraviolet Glass	Rising Color Temperature Glass	Blue Glass Protective
Falling Color Temperature Glass	Green Glass	Sky-light Glass
Violet Glass	Heat-absorbing Glass	Orange Glass
Protective Glass	Red Glass	Infrared Glass
Golden (Yellow) Glass	Multi-band Calibration Glass	

### Neutral Type Glass

#### Neutral Density Glass

Schott colored glass is alternative upon request.  
Spectrophotometer curve is available upon request.  
Coating is available upon request.

## Neutral Density (ND) Filter

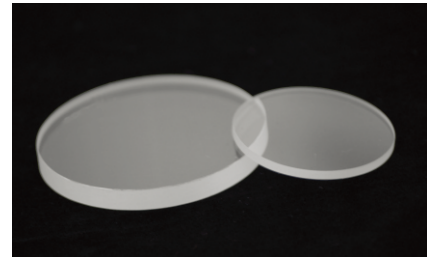
Neutral density (ND) filters are used to attenuate incident radiation without altering its spectral distribution. The neutral density value of an ND filter is related to the transmittance by:  
 $OD = \log(1/T)$ , OD: Optical Density; T: Transmittance.

### Absorption Glass ND Filter

It's made by Neutral Density glass. By adjust the thickness of the glass to get the defined OD value.

#### Specifications:

Material: .....Optical Neutral Density Glass  
 Flatness:.....  $2\lambda$  per 25 mm  
 Surface Quality:..... 80/50  
 Parallelism: .....3'  
 Dimension: .....circle (dia.25.4mm typical) or square  
 Dimension Tolerance: ..... 0.2mm  
 Optical Density Tolerance :.....+/-5%



### Metallic Coated Neutral Density Filter

Metallic coated ND filters are glass or quartz substrates with a precision metallic coating that provides uniform attenuation across a wide spectral range.

#### Specifications:

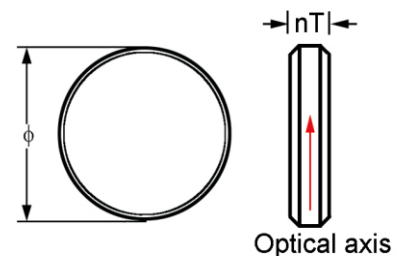
Material: .....BK7 glass and Fused Silica  
 Flatness:.....  $2\lambda$  per 25 mm  
 Surface Quality: .....80/50  
 Parallelism:..... 3'  
 Dimension Tolerance: ..... 0.2mm  
 Coating: .....Vacuum-deposited metallic alloy  
 Optical density Tolerance:..... +/-5%

## Birefringent Filter

JYS birefringent filters are made of crystal quartz. They are used in the laser cavity for wavelength selection. We can provide different thicknesses of birefringent filters for our customer's laser applications.

#### Specifications:

Material: .....Crystal Quartz  
 Parallelism:.....<5 arc seconds  
 Surface Quality: .....20-10 scratch and dig  
 Diameter Tolerance:.....+0.0,-0.2mm  
 Clear Aperture: .....90% of the central area  
 .....T=0.50mm  
 Thickness Tolerance: ..... 0.02mm





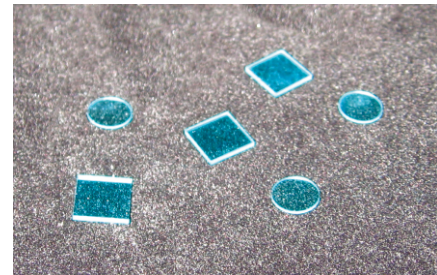
## IR Cut filter

### Absorption IR Cut Filter

It's fabricated by special blue glass (BG39 from Schott or equivalent). The glass will absorb IR wavelength and let visible light pass. It widely used for digital camera.

#### Specifications:

Material: ..... blue glass (BG39 or equivalent)  
Dimension: ..... 2mm ~ 200mm  
..... Square or round shape  
Flatness: .....  $\lambda/4$  typically  
Surface Quality: ..... 60-40  
Parallelism: ..... 3'  
AR/AR R<0.5% @465~650nm

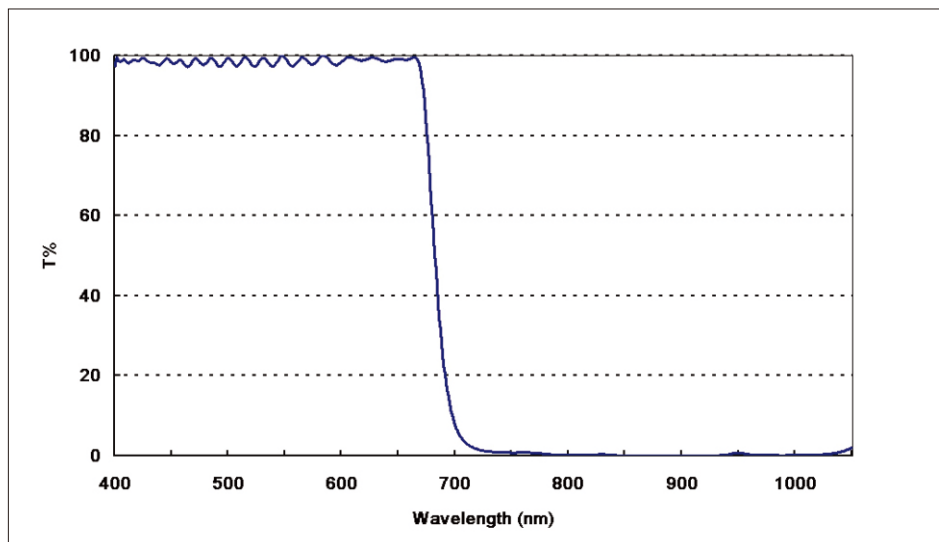


### Multi-layer Dielectric Coated IR Cut Filter

The substrate is normal optical glass (BK7 typically). With special designed coating, the filter can reflect IR wavelength and let visible light pass.

#### Specifications:

Material: ..... BK7  
Dimension: ..... 2mm ~ 200mm  
..... Square or round shape  
Flatness: .....  $\lambda/4$  typically  
Surface Quality: ..... 60-40  
Parallelism: ..... 3'.  
Tavg>90% @400~650nm & Tavg<2% @730~1050nm



## Bandpass Filter

Bandpass filters are optical elements that are designed to transmit a specific spectral band with high efficiency, while reject others. The characteristics of the bandpass are controlled by multilayer dielectric coatings.

### Long Pass Filter and Short Pass Filter

Long pass filter: Transmit the long wavelength and block the short wavelength.

Short pass filter: Transmit the short wavelength and block the long wavelength.

#### Specifications:

Material: .....BK7 optical glass or fused silica

Dimension: .....2mm ~ 100mm

.....Square or round shape

Flatness:..... $\lambda/4$  typically

Surface Quality: .....60-40

Parallelism:..... $3'$

Long pass transmission example:  $T < 1\%$  @ 200~560nm &  $T > 90\%$  @ 600~1200nm

### Narrow Band Pass Filter

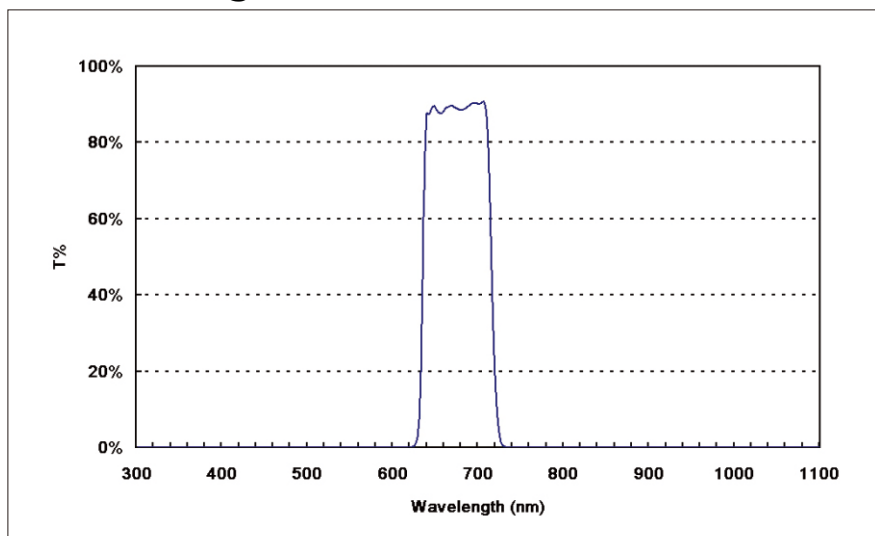
Only the light in a narrow wavelength range can be passed, the other wavelengths are blocked. It's cemented by long pass color glass piece and multi layer dielectric coated glass piece to get the maximum OD at block band while keeping the high transmission in the pass band.

Narrow band pass filter sample transmission:

$T > 80\%$  @ 650~680nm

$T < 0.1\%$  @ 300~600nm,  $OD > 3$  @ 300~600nm

$T < 0.1\%$  @ 750~1100nm,  $OD > 3$  @ 750~1100nm



## IPL Filter & IPL Crystal (IPL Light Guide)

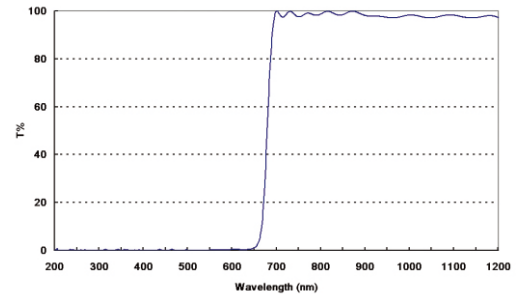
IPL Filter is the key optical element for IPL (intense Pulsed Light) machine, which filter the UV wave and reserve the useful wave from 400nm to 1200nm for cosmetic laser, such as hair removal, vascular and acne treatment.

JYS fabricate all kinds of IPL Filter & Internal Filters, which made by BK7 Glass, Fused silica or sapphire crystal. The available coating wavelengths are 495, 515, 550, 560, 570, 590, 615, 645, 695, 755 and 780 nm.

JYS fabricate the IPL light guide (IPL crystal) with optical grade BK7, fused silica or sapphire crystal. All the 6 surfaces are fine polished to get the high transmission efficiency.

### IPL Filter Specifications:

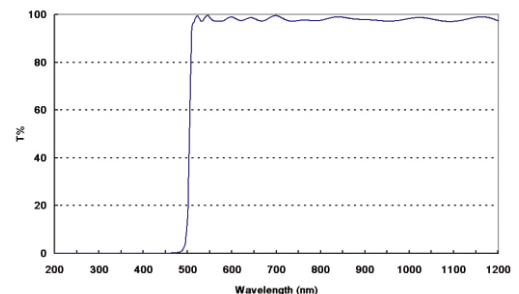
Material:.....BK7, Fused silica or Sapphire crystal.  
Common dimension:.....45x10x10mm  
Dimension Tolerance:..... 0.1mm  
Surface Quality:..... 60/40  
Clear Aperture:..... >90%  
Parallelism: .....3 min  
Wavefront Distortion:..... $\lambda/2@632.8\text{nm}$   
Bevel: .....0.2 0.4mmx45  
Wavelength:  
495~1200nm, 515~1200nm, 530~1200nm, 550~1200nm,  
560~1200nm, 570~1200nm, 590~1200nm, 615~1200nm,  
645~1200nm, 695~1200nm, 755~1200 nm, 780~1200 nm  
Custom size and wavelength are available upon request



Transmission of IPL Filter coating 695~1200nm

### IPL Light Guide Specifications:

Material:..... BK7, Fused Silica, Sapphire, etc.  
Dimension Tolerance:..... 0.1mm  
Surface Quality:..... 60/40  
Clear Aperture:..... >90%  
Parallelism:..... <1arc min  
Flatness: ..... $<\lambda/2$  per inch area @633nm  
Bevel: .....<0.2 0.4mmx45  
Chip:..... <0.2mm  
Custom size is available upon request.



Transmission of IPL Filter coating 515~1200nm



Front surface mirrors are coated with aluminum or dielectrics for maximum reflection. JYS provides both kinds of front surface mirrors: Metal mirror and Dielectric coated mirror.

Substrate:

1. Commercial quality flat window or precision window. Please refer to the optical window chapter at page 4. Ground back surface is available upon request.
2. Plano concave lens chapter at page 27. After high reflection coating on the concave face, it's a concave mirror.



## Metal Coated Mirror

After aluminium (Al), silver (Ag) or Gold (Au) coating, the mirror shows high reflection performance for very wide broadband. Generally, we overcoat the protective SiO<sub>2</sub> or MgF<sub>2</sub> layer outside layer to avoid the damage from the environment.

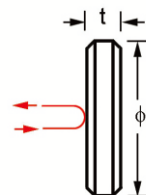
Metal coating is less sensitive to variations in incident angle, polarization, and wavelength than dielectric coatings.

Coating Type	Description & Reflection Ratio
UV enhanced Al+ MgF <sub>2</sub> coating	Al coating has higher reflection than Ag or Au coating at UV to visible range By special design, JYS can do the coating of the UV enhanced Al + MgF <sub>2</sub> with <b>Ravg&gt;85% @ 250nm~700nm</b>
Protective Al+ SiO <sub>2</sub> coating	<b>Ravg&gt;90% @ 400nm~10.0μm</b>
Protective Ag+ SiO <sub>2</sub> coating	<b>Ravg&gt;95% @ 600nm~10.0μm</b>
Gold coating	<b>Ravg&gt;96% @ 700nm~20μm</b> <b>Ravg&gt;98% @ 600nm~16μm</b>

## Dielectric High Reflection Coated Mirror

After dielectric high reflection coating, the mirror has very high reflection for specified single wavelength or broadband wavelength.

For example: HR R>99.8% @ 1064nm, AOI=0deg.



## Dichroic Mirror/ Beamsplitter

With special designed multi layer dielectric coating, the mirrors reflect some wavelength while transmit other wavelength.

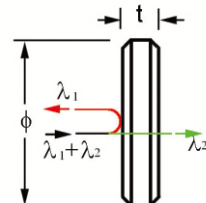
It can be used to split or combine different wavelength.

It can be also used in SHG laser system as Harmonic Separators.

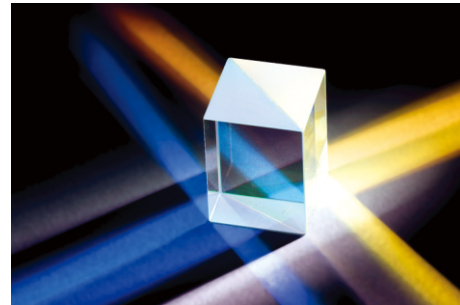
Coating example for SHG 1064nm-->532nm application:

S1: HR R>99.5% @ 1064nm & HT T>90% @ 532nm, AOI=0deg.

S2: AR R<0.25% @ 532nm, AOI=0deg.



Beamsplitters are used to split or combine beam of light. Plates and cubes are the most common types. The performance of beamsplitters are mainly dependent on the coating specifications. In selecting beamsplitters, the forms, coating, transmission and damage threshold should be considered.

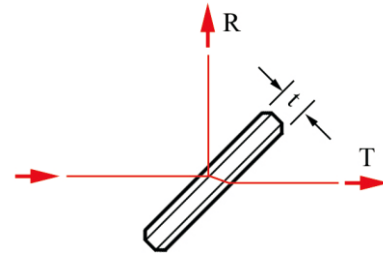


## Beamsplitter Plate

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

### Specifications:

Material: .....BK7 Grade A Optical Glass  
Dimension Tolerance: ..... 0.2mm  
Thickness Tolerance:..... 0.2mm  
Flatness: ..... $\lambda/4$  @ 632.8 nm per inch  
Surface Quality: .....60/40 scratch and dig  
Parallelism:.....1 arc minute  
T/R:.....50/50 $\pm$ 5%, for natural light  
..... $T=(T_s+T_p)/2$ ,  $R=(R_s+R_p)/2$   
Coatings:..... (Incidence angle: 45 degree)  
S1:..... Partial Reflectance  
S2: .....AR coatings



## Beamsplitter Cube

Compared with beamsplitter plate, beamsplitter cube has the following advantages:

*Identical path lengths for both the reflected and the transmitted beams*

*The transmitted beam is neither displaced nor deflected.*

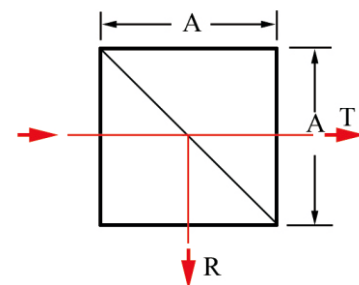
*Stable and compact.*

*Easy operation.*

*Easy to Mount/Align*

### Specifications:

Material:..... BK7 Grade A Optical Glass  
Dimension Tolerance: ..... 0.2mm  
Flatness:..... $\lambda/4$  @ 632.8 nm per inch  
Surface Quality: .....60/40 scratch and dig  
T/R: .....50/50 5% for natrual light  
..... $T=(T_s+T_p)/2$ ,  $R=(R_s+R_p)/2$   
Beam Deviation: .....<3 arc minutes  
Coatings:.....  
Partial reflectance:..... on hypotenuse face  
AR-coatings:..... on all input and output faces



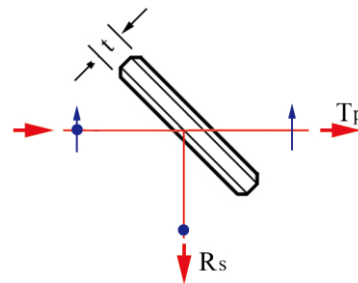
## Polarizing Beamsplitter Cube

The prisms can be used as polarizers, beamsplitters or beam combiners. The output beam which are parallel to input beam is called p-polarized beam while the orthogonal output beam is defined as s-polarized beam.

## Narrow Band Polarizing Beamsplitter

### Specifications:

Material: .....BK7 Grade A Optical Glass  
Dimension Tolerance: ..... 0.2mm  
Surface Quality: .....60-40 scratch and dig  
Beam Deviation: .....3 arc minutes  
Extinction Ratio: .....> 100:1  
Principal Transmittance: ..... $T_p > 95\%$  and  $T_s < 1\%$   
Principal Reflectance:.....  $R_s > 99\%$  and  $R_p < 5\%$   
Coatings: .....  
Polarization beamsplitter coating :..... on hypotenuse  
AR coating: ..... $R < 0.25\%$  per face for other 4 faces

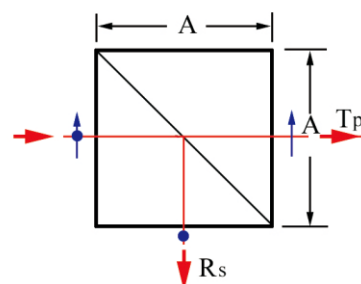


Plate

## Broadband Polarizing Beamsplitter

### Specifications:

Material: .....BK7 Grade A Optical Glass  
Dimension Tolerance: ..... 0.2mm  
Surface Quality: .....60-40 scratch and dig  
Beam Deviation: .....3 arc minutes  
Extinction Ratio: .....> 100:1  
Principal Transmittance: ..... $T_p > 95\%$  and  $T_s < 1\%$   
Principal Reflectance:.....  $R_s > 99\%$  and  $R_p < 5\%$   
Coatings: .....  
BBAR coating : .....on all input and output face  
Broadband polarization beamsplitter coating: on hypotenuse

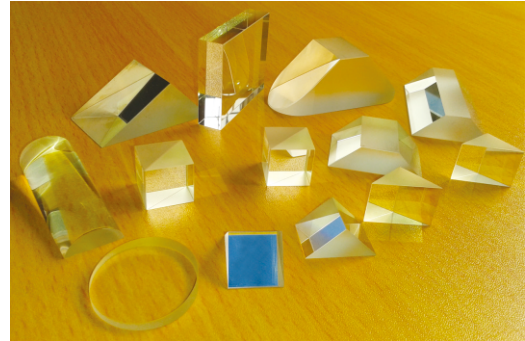


Cube



## Right-Angle Prism

A Right-Angle Prism is used as a mirror to deviate light through 90 degree, and also as a retroreflector to deflect light through 180 degree by total internal reflection.

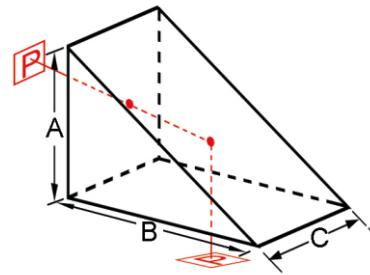


### 90-degree Deflection

90 degree deflection occurs at the hypotenuse face. The image is erected and reversed.

#### Specifications:

Material:..... BK7 Glass or UV Fused Silica  
Dimension Tolerance: .....+0.0, -0.2 mm  
Clear Aperture:..... >85%  
Beam deviation: .....3', 1' or 30"  
Flatness: ..... $\lambda/2$  @632.8 nm per inch  
Surface Quality: .....60-40 scratch and dig  
Protective Bevel

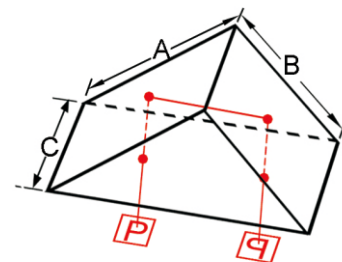


### 180-degree Deflection

180 degree deflection uses the hypotenuse as the entrance and exit face. The main application of it is used as a retroreflector provided that the plane of incident beam includes the vertex. This prism is also called *Porro Prism*

#### Specifications:

Material:..... BK7 Glass or UV Fused Silica  
Dimension Tolerance: .....+0.0, -0.2 mm  
Clear Aperture:..... >85%  
Beam deviation: .....3', 1' or 30"  
Flatness: ..... $\lambda/2$  @632.8 nm per inch  
Surface Quality: .....60-40 scratch and dig  
Protective Bevel

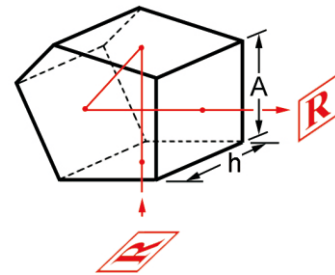


## Penta Prism

The deviation angle of  $90^\circ$  is independent of the orientation of the prism, making it especially important in applications in which the prism orientation can not be precisely controlled. Due to geometry that total internal reflection cannot be used, the reflecting surfaces must be coated with a metallic or dielectric coating. The standard Penta Prism reflecting surfaces are coated with aluminum (see Coating chapter). Sometimes, the coated surfaces are painted black.

### Specifications:

Material: .....BK7 Grade A Optical Glass  
Dimension Tolerance: ..... 0.25mm  
 $90^\circ$  Deviation Tolerance:.....  
Standard series: ..... < 30 arc seconds  
Precision series: ..... up to 10 arc seconds  
Flatness:.....  
Standard series:.....  $\lambda/2$  @ 632.8 nm per inch  
Precision series: ..... up to  $\lambda/4$  @ 632.8 nm per inch  
Reflectivity: ..R > 95% per face from 630 to 680 nm  
Surface Quality:.. ..... 60-40 scratch and dig

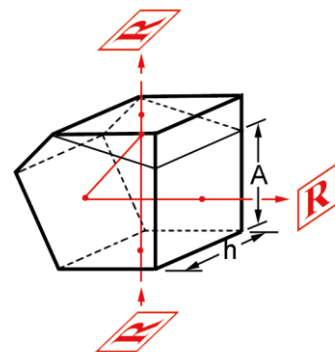


## Beamsplitter Penta Prism

By adding a wedge and with partial reflective coating, a Penta Prism can be used as a Beamsplitter. Transmission/reflection (T/R) ratio of 20/80, 50/50 or others for Beamsplitter Penta Prism is available upon request.

### Specifications:

Material: .....BK7 Grade A Optical Glass  
Dimension Tolerance: ..... 0.25 mm  
 $90^\circ$ ,  $180^\circ$  Deviation Tolerance:.....  
Standard series:..... < 30 arc seconds  
Precision series: ..... up to 15 arc seconds  
Flatness:.....  
Standard series: .....  $\lambda/2$  @ 632.8 nm per inch  
Precision series: ..... up to  $\lambda/4$  @ 632.8 nm per inch  
Surface Quality:..... 60-40 scratch and dig  
Beamsplitter Ratio T/R: ...20/80 5 @ 630-680nm

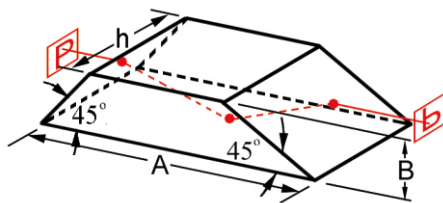


## Dove Prism

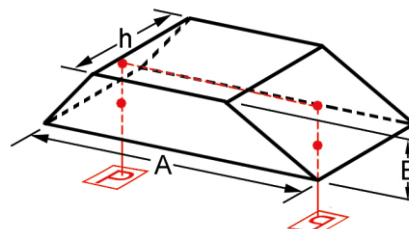
Dove prism has two applications. The main application is used as a rotator. It can rotate an image but without deviating the beam. And when the prism is rotated about the input parallel ray through some angle, the image rotates through twice that angle. It is very important that the application must be used with parallel or collimated beam and the large square reflective surface should be kept very clean. Another application is used as a retroreflector. For this application it performs as a porro prism.

### Specifications:

Material .....BK7 Grade A Optical Glass  
Dimension (B,h) Tolerance ..... +0.0, -0.2 mm  
Dimension (A) Tolerance ..... 0.2 mm  
Clear Aperture ..... >85%  
Angle Tolerance ..... 3 arc minutes  
Flatness .....  $\lambda/2$  @632.8 nm per inch  
Surface Quality ..... 60-40 scratch and dig  
Protective Bevel



90 Deflection



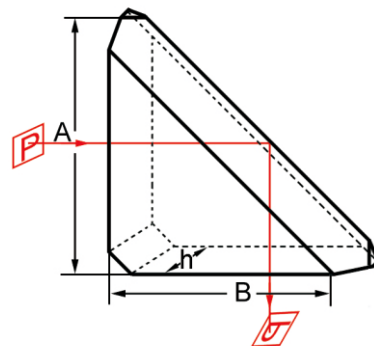
180 Deflection

## Roof Prism

Roof prism is combined with a right angle prism and a totally internally reflecting roof attached to the hypotenuse. It can invert and reverse an image, also, deflect the image 90deg. Therefore, it is often used in terrestrial telescopes, viewing systems and rangefinders.

### Specifications:

Material:..... BK7 Grade A Optical Glass  
Dimension (A) Tolerance: .....+0.0, -0.2 mm  
Dimension (B) Tolerance: ..... 0.3 mm  
Dimension (h) Tolerance: ..... 0.2 mm  
Clear Aperture: ..... >85%  
Roof Angle Tolerance: ..... 3 arc minutes  
Flatness: .....  $\lambda/2$  @632.8 nm per inch  
Surface Quality: .....60-40 scratch and dig  
Protective Bevel

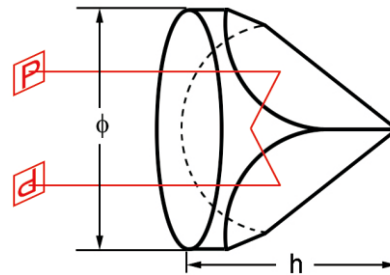


## Corner Cube Retroreflectors

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

### Specifications:

Material: .....BK7 Grade A Optical Glass  
Dimension Tolerance: .....+0.0, -0.2 mm  
Clear Aperture: .....>85%  
Deviation: .....180 3 arc seconds  
Flatness: ..... $\lambda/4$  @632.8 nm on big surface  
..... $\lambda/10$  @632.8 nm on other surface  
Surface Quality: .....60-40 scratch and dig  
Wavefront Distortion: ..... $\lambda/2$  @632.8nm  
Protective Bevel

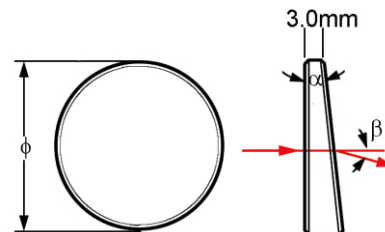


## Wedge Prism

Wedge prisms have similar functions with optical windows. They all can be used as isolating components. Wedges may be used to produce a small deviation, which do not allow return to the source.

### Specifications:

Material .....BK7 Grade A Optical Glass  
Design Wavelength ..... 632.8nm  
Design Index .....  $n=1.51467$  at 632.8nm  
Diameter Tolerance ..... +0.0, -0.1mm  
Thickness Tolerance ..... 0.2mm  
Surface Quality ..... 60-40 scratch and dig  
Wedge Angle Tolerance..... 1 arc minute  
Flatness ..... $\lambda/4$  @ 632.8 nm  
Protective Bevel

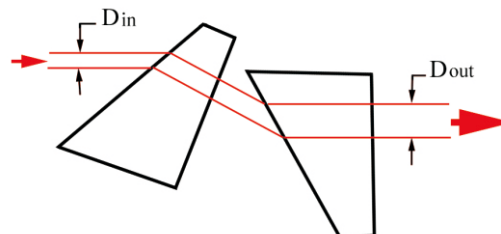


## Anamorphic Prism

These two prisms can expand or contract the beam in one direction without any changes in the other direction. By adjusting the angles among the incident beam and two prisms, the shape of the beam can be changed. It is very easy to turn elliptical beams into circular beam.

### Specifications:

Material: .....BK7 Grade A Optical Glass  
Dimension Tolerance: .....+0.0,-0.15mm  
Clear aperture: .....>85% of the central area  
Surface quality:..... 60-40 scratch and dig  
Flatness: ..... $\lambda/4$ @632.8nm  
Coating: MgF2 single layer on perpendicular surface



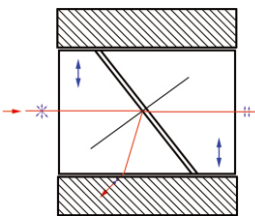
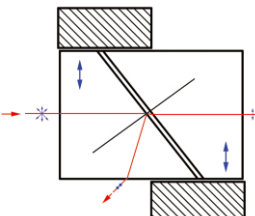
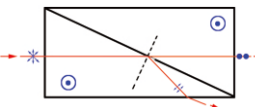
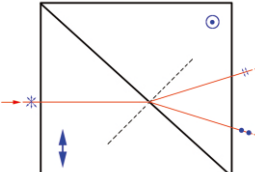
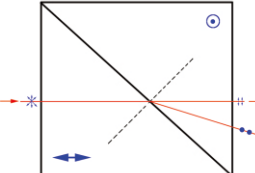
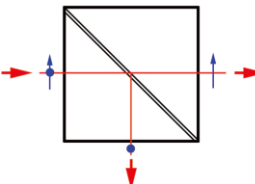
Polarizer is widely used in polarizing application. JYS provide following polarizers with  $\alpha$ -BBO, Calcite or YVO4 material to suit for wide spectrum and high polarization purity application.

Material Transmission range:

$\alpha$  - BBO: 190-3500nm

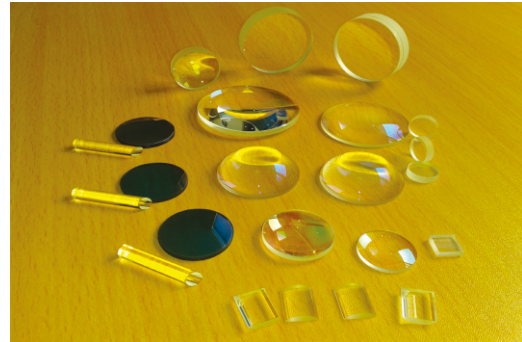
Calcite: 350-2300nm

YVO4: 450-5000nm

Polarizer	Illustration	Properties and Application
Glan-Taylor Polarizer		Air-spaced Cutting angle close to Brewster's Angle. The extraordinary ray passes through with little deviation. Sealed mount without escape windows is suitable for low to medium power application where the rejected beam is not required.
Glan-Laser Polarizer		Cutting angle close to Brewster's Angle. Mounted with escape windows. Therefore, it is suitable for high power applications.
Glan-Thompson Polarizer		Cemented. Suitable for low power applications. Special design for the ratio of L/A (length/aperture) guarantees the wide acceptance angle.
Wollastom Polarizer		Cemented. Both ordinary and extraordinary beams are deviated. Suitable for low power application and where the large deviations are required.
Rochon Polarizer		Split the ordinary and extraordinary ray, but only the extraordinary beam is deviated. Wide wavelength range.
Polarization Beamsplitter		Split the ordinary and extraordinary ray, but only the extraordinary beam is deviated. Wide wavelength range.



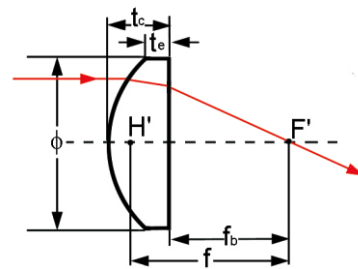
Lenses have many applications ranging from the simple collection of a laser beam to precise imaging and image transfer. Lenses are classified as single lenses, cylindrical lenses and achromatic lenses. These lenses are made of BK7, Fused Silica and other optical material. Special focusing systems can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



## Plano Convex Lens

### Specifications:

Material: .....BK7 or UV Fused Silica  
Design Wavelength: .....546.1nm  
Design Index:.....  
BK7: .....1.5187 0.0005  
Fused Silica: .....1.4601 0.0005  
Diameter Tolerance: .....+0.0, -0.15mm  
Paraxial Focal Length: ..... 2%  
Centration: .....3 arc minutes  
Clear Aperture:..... >90%  
Surface Irregularity: ..... $\lambda/4@632.8\text{nm}$   
Surface Quality: .....60-40 scratch and dig  
Protective Bevel

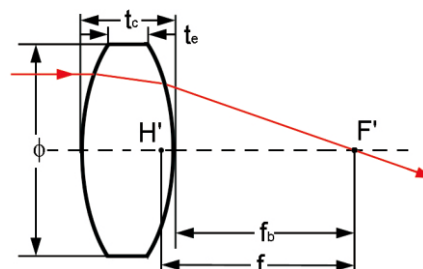


Other materials are also available. AR coating is available upon request.

## Double Convex Lens

### Specifications:

Material: .....BK7 or UV Fused Silica  
Design Wavelength: .....546.1nm  
Design Index:.....  
BK7: .....1.5187 0.0005  
Fused Silica: .....1.4601 0.0005  
Diameter Tolerance: .....+0.0, -0.15mm  
Paraxial Focal Length: ..... 2%  
Centration: .....3 arc minutes  
Clear Aperture:..... >90%  
Surface Irregularity: ..... $\lambda/4@632.8\text{nm}$   
Surface Quality: .....60-40 scratch and dig  
Protective Bevel



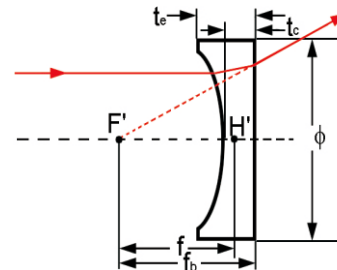
Other materials are also available. AR coating is available upon request.

## Plano Concave Lens

### Specifications:

Material: .....BK7 or UV Fused Silica  
 Design Wavelength: .....546.1nm  
 Design Index:.....:  
 BK7: .....1.5187 0.0005  
 Fused Silica: .....1.4601 0.0005  
 Diameter Tolerance: .....+0.0, -0.15mm  
 Paraxial Focal Length: ..... 2%  
 Centration: .....3 arc minutes  
 Clear Aperture:..... >90%  
 Surface Irregularity: ..... $\lambda/4@632.8\text{nm}$   
 Surface Quality: .....60-40 scratch and dig  
 Protective Bevel

Other materials are also available. AR coating is available upon request.

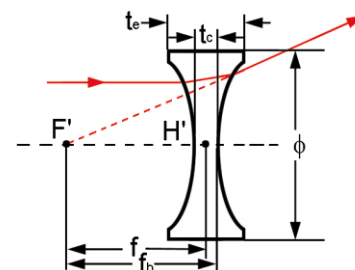


## Double Concave Lens

### Specifications:

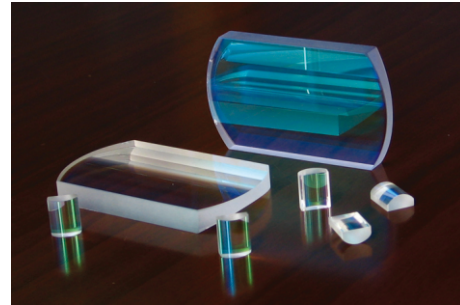
Material: .....BK7 or UV Fused Silica  
 Design Wavelength: .....546.1nm  
 Design Index:.....:  
 BK7: .....1.5187 0.0005  
 Fused Silica: .....1.4601 0.0005  
 Diameter Tolerance: .....+0.0, -0.15mm  
 Paraxial Focal Length: ..... 2%  
 Centration: .....3 arc minutes  
 Clear Aperture:..... >90%  
 Surface Irregularity: ..... $\lambda/4@632.8\text{nm}$   
 Surface Quality: .....60-40 scratch and dig  
 Protective Bevel

Other materials are also available. AR coating is available upon request.



## Cylindrical Lens

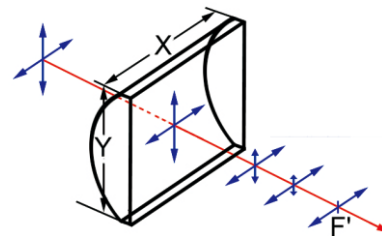
Used to provide focusing power in one section only. For illumination or detection of light from line sources. Also used for anamorphic compression of beams and images.



## Plano-Convex Cylindrical Lens

### Specifications:

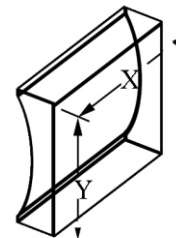
Material: .....BK7 or UV Fused Silica  
Design Wavelength: .....632.8nm  
Design Index:..... $n=1.5147$   
Surface Irregularity:..... $\lambda/2$  in y direction  
..... $\lambda/4$  per centimeter in x direction, @ 632.8nm  
Diameter Tolerance: ..... 0.2mm  
Paraxial Focal Length: ..... 2%  
Centration: .....3 arc minutes  
Clear Aperture:..... >90%  
Surface Quality: .....60-40 scratch and dig  
Protective Bevel



## Plano-Concave Cylindrical Lens

### Specifications:

Material: .....BK7 or UV Fused Silica  
Design Wavelength: .....632.8nm  
Design Index:..... $n=1.5147$   
Surface Irregularity:..... $\lambda/2$  in y direction  
..... $\lambda/4$  per centimeter in x direction, @ 632.8nm  
Diameter Tolerance: ..... 0.2mm  
Paraxial Focal Length: ..... 2%  
Centration: .....3 arc minutes  
Clear Aperture:..... >90%  
Surface Quality: .....60-40 scratch and dig  
Protective Bevel

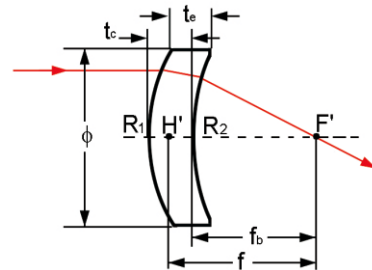


## Meniscus Lens

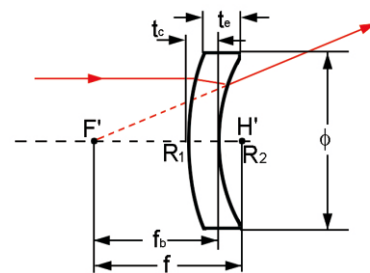
- Positive Meniscus Lens
- Negative Meniscus Lens

### Specifications:

Material ..... BK7 or UV Fused Silica  
Design Wavelength ..... 546.1nm  
Design Index (BK7) ..... 1.5187 0.0005  
Design Index (Fused Silica)..... 1.4601 0.0005  
Diameter Tolerance ..... +0.0, -0.15mm  
Paraxial Focal Length ..... 2%  
Centration..... 3 arc minutes  
Clear Aperture ..... >90%  
Surface Irregularity .....  $\lambda/4$  per 25mm @ 632.8nm  
Surface Quality ..... 60-40 scratch and dig  
Protective Bevel



Positive Meniscus Lens



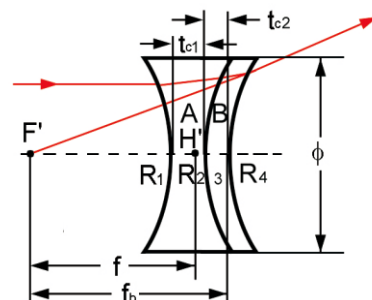
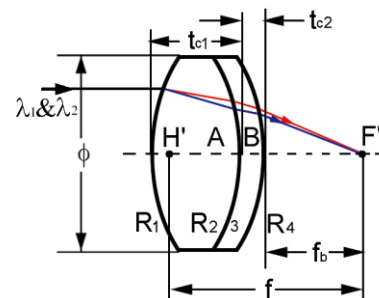
Negative Meniscus Lens

## Achromatic Lens

These lenses have considerably reduced values of spherical aberration and Chromatic aberrations. Best used to replace single components where performance must be improved.

### Specifications:

Design Wavelength: .480.0nm,546.1nm,632.8nm  
Diameter Tolerance: ..... +0.0,-0.15mm  
Paraxial Focal Length: ..... 2% @ 546.1nm  
Centration: ..... 3 arc minutes  
Clear Aperture:..... >90%  
Surface Irregularity:.....  $\lambda/4$  per 25mm @ 632.8nm  
Surface Quality: ..... 60-40 scratch and dig  
Coating: Single layer MgF2 broadband AR coating  
Protective Bevel



## Laser Crystal

### Ti:Sapphire

Ti<sup>3+</sup>:Al<sub>2</sub>O<sub>3</sub> :- titanium-doped sapphire crystals combine supreme 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 challenge "dirty" dyes in variety of applications. Medical laser systems, lidars, laser spectroscopy, direct femtosecond pulse generation by Kerr-type mode-locking - there are few of existing and potential applications.

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

### 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.

### Nd:YVO<sub>4</sub>

Yttrium vanadate has been growing in popularity because of its 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. These advantages make Nd:YVO<sub>4</sub> is a better choice than Nd:YAG for low-power devices such as hand-held pointers, and others compact lasers.

Laser Crystal	Ti:Sapphire	Nd:YAG	Nd:YVO <sub>4</sub>
<b>Physical and Optical Properties</b>			
Chemical formula	Ti <sup>3+</sup> : Al <sub>2</sub> O <sub>3</sub>	Nd:Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub>	Nd:YVO <sub>4</sub>
Crystal structure	Hexagonal	Cubic	Zircon Tetragonal, space group D <sub>4h</sub> ,
Melting point	2050°C	1970°C	
Density	3.98 g/cm <sup>3</sup>	4.56 g/cm <sup>3</sup>	4.22 g/cm <sup>3</sup>
Mohs hardness	9	8.5	Glass-like, ~5
Thermal conductivity Coefficient	0.11 cal/(°C x sec x cm)	14 W/m /K @20 °C, 10.5 W /m /K @100 °C.	C: 5.23 W/m/K; ^C: 5.10 W/m/K
Thermal Expansion Coefficient		7.8 x 10 <sup>-6</sup> /K [111], 0 - 250 °C	a <sub>a</sub> =4.43x10 <sup>-6</sup> /K, a <sub>c</sub> =11.37x10 <sup>-6</sup> /K
Lasing Wavelength	660~1050 nm (795 nm)	1064 nm	914nm, 1064 nm, 1342 nm
Absorption range	400~600 nm (488 nm)	lamp pump	808nm
Lattice constants	a=4.748, c=12.957	12.01	a=b=7.12, c=6.29
Fluorescence lifetime	3.2 $\mu$ sec (T = 300 K)	230msec	90 msec (about 50 m s for 2 atm% Nd doped) @ 808 nm
Absorption Coefficient	1.0~7.5cm <sup>-1</sup> @490nm	7.1 cm <sup>-1</sup>	31.4 cm <sup>-1</sup> @ 808 nm
Refractive index	1.76 @ 800 nm	1.82 @1064nm	n <sub>o</sub> =1.9573, n <sub>e</sub> =2.1652 @ 1064nm
Polarized Emission	Unpolarized	Unpolarized	parallel to optic axis (c-axis)



Laser Crystal	Ti:Sapphire	Nd:YAG	Nd:YVO4
<b>Typical Specification and Tolerance</b>			
concentration	0.06~0.5 wt% Ti dopant	0.5~1.2 atm% Nd dopant (10% tolerance)	0.2 ~ 3 atm% Nd dopant (10% tolerance)
Figure of Merit	100~300		
Aperature	2~50mm	3 ~ 14mm	1 ~ 20mm
Path Length	2~130mm	1 ~ 160mm	0.02 ~ 20mm
End configuration	flat/flat or Brewster/Brewster ends or Specified	flat/flat or Brewster/Brewster ends or Specified	flat/flat or Brewster/Brewster ends or Specified
Orientation	Optical axis C normal to rod axis	<111> crystalline direction (+/-0.5°C)	a-cut crystalline direction (+/-0.5°C)
parallelism	< $\lambda$ /10 arc seconds		
Surface quality	better than 60/40 scratch/dig per MIL-O-13830A	better than 20/10 Scratch/Dig per MIL-O-1380A	better than 20/10 Scratch/Dig per MIL-O-1380A
Surface flatness	< $\lambda$ /10 @633nm	< $\lambda$ /10 at 632.8nm	< $\lambda$ /10 at 632.8nm
Wavefront distortion	< $\lambda$ /4 per inch @ 633 nm	< $\lambda$ /10 at 632.8nm for 3 ~7mm < $\lambda$ /8 per inch at 632.8nm for $\geq$ 7mm	< $\lambda$ /8 at 633nm
Perpendicularity	< 5 arc minutes	< 5 arc minutes	< 5 arc minutes
Clear aperture	Central 90%	Central 95%	Central 95%
Chamfer	0.15x44°	0.15x45°	0.15x45°
Damage threshold	over 15J/cm <sup>2</sup> (rods without coating) over 700MW/cm <sup>2</sup> (coating)	over 15J/cm <sup>2</sup> (rods without coating) over 700MW/cm <sup>2</sup> (coating)	over 15J/cm <sup>2</sup> (rods without coating) over 700MW/cm <sup>2</sup> (coating)
Coatings	AR@700~1100nm	a) AR@1064nm,R<0.1% b) AR@1064nm,R<0.1%; HT@808nm,T>95%; c) HR@1064nm,R<99.8%; HT@808nm,T>95%; d) HR@1064nm,R<99.8%; HT@808nm,T>95%; HR@532nm,R>99%;	a) AR@1064nm,R<0.1% b) AR@1064nm,R<0.1%; HT@808nm,T>95%; c) HR@1064nm,R<99.8%; HT@808nm,T>95%; d) HR@1064nm,R<99.8%; HT@808nm,T>95%; HR@532nm,R>99%;

NLO Crystal	BBO	KTP	LBO	LiNbO3
<b>Physical and Optical Properties</b>				
<b>NLO theory</b>				
Crystal Structure	trigonal, space group R3c	Orthorhombic, point group mm 2	Orthorhombic, point group mm 2	Trigonal, space group R 3c
Transparency Range	189 - 3500 nm	350nm~4500nm	160 - 2600 nm	420 - 5200 nm
Cell Parameters	a=b=12.532Å, c=12.717Å	a=6.404Å, b=10.616Å, c=12.814Å	a=8.44731Å, b=7.3788Å, c=5.1395Å	a = 0.515Å, c = 13.863Å
Melting Point	1095 +/-5°C	1172°C incongruent	834°C	1255 +/-5°C
Curie point	925 +/-5°C	936°C		1140 +/-5°C
Optical Homogeneity	$\Delta n \approx 10^{-6}$ /cm	$\Delta n \approx 10^{-6}$ /cm	$\Delta n \approx 10^{-6}$ /cm	$\Delta n \approx 5 \times 10^{-5}$ /cm
Mohs Hardness	4.5	5	6	5
Density	3.85 g/cm <sup>3</sup>	3.01 g/cm <sup>3</sup>	2.47g/cm <sup>3</sup>	4.64 g/cm <sup>3</sup>
Thermal Conductivity	<sub>c</sub> , 0.012Wcm/K;    <sub>c</sub> , 0.016 W/m/K	0.13 W/cm/°K	0.035 W/cm/K	0.046W/cm/K`
Phase-matchable SHG range	205nm-1750nm	1000-2000nm	800-2000nm	1100-3000nm
Absorption Coefficient	< 0.1%/cm (at 1064 nm)	< 1%/cm @1064 nm and 532nm	<=1%/cm at 1064nm	<0.1%/cm @ 1064 nm
NLO coefficients	D21 =2.2pm/V D31 =0.08pm/V D22 =2.2pm/V	d31 =1.95pm/V, d32 =3.90pm/V, d33 =15.3pm/V d24 =3.90 pm/V, d15 =1.95pm/V	D21 =0.67pm/V, d22 =0.04 pm/V d23 =0.85pm/V d34 =0.85pm/V d16 =0.67 pm/V	d21= d22= d16 =2.6pm/V d31= d32 = d32 =4.6pm/V d33=25.6pm/V
Damage Threshold at 1.064 mm	12.9J/cm <sup>2</sup> 9.9GW/cm <sup>2</sup>	6.0J/cm <sup>2</sup> ; 4.6GW/cm <sup>2</sup>	24.6J/cm <sup>2</sup> ; 18.9GW/cm <sup>2</sup>	200 MW/cm <sup>2</sup>
Refractive Indices at 1.0642 mm at 0.5321 mm	n <sub>e</sub> = 1.5425, n <sub>o</sub> = 1.6551 n <sub>e</sub> = 1.5555, n <sub>o</sub> = 1.6749	N <sub>x</sub> = 1.73991 N <sub>y</sub> = 1.74802 N <sub>z</sub> = 1.82956 N <sub>x</sub> = 1.77903 N <sub>y</sub> = 1.79002 N <sub>z</sub> = 1.88628	N <sub>x</sub> = 1.56447 N <sub>y</sub> = 1.59050 N <sub>z</sub> = 1.60538 N <sub>x</sub> = 1.57842 N <sub>y</sub> = 1.60650 N <sub>z</sub> = 1.62154	N <sub>o</sub> = 2.23216 N <sub>e</sub> = 2.15600 N <sub>o</sub> = 2.32309 N <sub>e</sub> = 2.23415
<b>Typical Specification and Capabilities</b>				
Angle tolerance	$\Delta\theta < \pm 0.5^\circ$ ; $\Delta\varphi < \pm 0.5^\circ$	$\Delta\theta < \pm 0.5^\circ$ ; $\Delta\varphi < \pm 0.5^\circ$	$\Delta\theta < \pm 0.5^\circ$ ; $\Delta\varphi < \pm 0.5^\circ$	$\Delta\theta < \pm 0.5^\circ$ ; $\Delta\varphi < \pm 0.5^\circ$

NLO Crystal	BBO	KTP	LBO	LiNbO3
Dimension tolerance	(W ± 0.1mm) x (H ± 0.1mm) x (L + 0.2mm/-0.1mm)	(W ± 0.1mm) x (H ± 0.1mm) x (L + 0.2mm/-0.1mm)	(W ± 0.2mm) x (H ± 0.2mm) x (L + 0.2mm/-0.2mm)	(W ± 0.1mm) x (H ± 0.1mm) x (L + 0.2mm/-0.1mm)
Flatness	< λ / 8 @ 633nm	< λ / 8 @ 633nm	< λ / 4 @ 632.8nm	< λ / 8 @ 633nm
Scratch/Dig code	better than 10/5 Scratch/dig per MIL-O-13830A	better than 10/5 Scratch/dig per MIL-O-13830A	better than 10/5 Scratch/dig per MIL-O-13830A	better than 10/5 Scratch/dig per MIL-O-13830A
Parallelism	< 20 arc seconds	< 20 arc seconds	< 20 arc seconds	< 20 arc seconds
Perpendicularity	< 5 arc minutes	< 5 arc minutes	< 30 arc minutes	< 5 arc minutes
Wavefront distortion	< λ / 8 @ 633nm	< λ / 8 @ 633nm	< λ / 4 @ 632nm	< λ / 4 @ 632nm
Clear aperture	> 90% central area	> 90% central area	> 80% central area	> 90% central area
Aperture	1x1 ~ 12x12mm	1x1 ~ 10x10mm	2 ~ 10mm	1~50 mm
Length	0.02 ~ 25mm	0.05 ~ 20mm	0.3~20 mm	0.3~20 mm
Phase matching type	Type I or Type II	Type II	Type I or Type II	Type I or Type II
End configuration	Flat or Brewster or Specified	Flat or Brewster or Specified	Flat, spherical, parallel and wedged	Flat, spherical, parallel and wedged
Typical Coating	Antireflective coating	Antireflective coating Highreflective Coating	Antireflective Coating	Antireflective Coating

## BBO Nonlinear Crystals

### BBO

BBO (beta-BaB<sub>2</sub>O<sub>4</sub>) 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 online\_orderings.

Capabilities:

- 1) Aperture: 1x1 ~ 12x12mm
- 2) Length: 0.02 ~ 25mm
- 3) Phase matching angle  $\theta$  and  $\phi$ : Determined by different kinds of homonic generation.
- 4) Phase matching type: Type I or Type II
- 5) End configuration: Flat or Brewster or Specified

Typical Specification and Tolerance:

- 1) Angle tolerance:  $\Delta\theta < \pm 0.2^\circ$ ;  $\Delta\phi < \pm 0.2^\circ$
- 2) Dimension tolerance:  $(W \pm 0.1\text{mm}) \times (H \pm 0.1\text{mm}) \times (L + 0.2\text{mm}/-0.1\text{mm})$
- 3) Flatness:  $< \lambda/8$  @ 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:  $< \lambda/8$  @ 633nm
- 8) Clear aperture:  $> 90\%$  central area
- 9) Coating: Protective Coating or Anti-Reflection

## KTP

KTP (KTiOPO<sub>4</sub>) 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 online\_ordering.

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

### Capabilities :

- 1) Aperture:  $1 \times 1 \sim 10 \times 10 \text{mm}$
- 2) Length:  $0.05 \sim 20 \text{mm}$
- 3) Phase Matching Angle:  
Determined by different homonic generation  
typical  $\theta = 90^\circ$ ;  $\varphi = 23.5^\circ$  for SHG  $1064 \text{nm}$
- 4) Phase matching type: Type II
- 5) Typical Coating:
  - a) AR @  $1064 \text{nm}$   $R < 0.1\%$ ; AR @  $532 \text{nm}$ ,  $R < 0.25\%$ .
  - b) HR @  $1064 \text{nm}$ ,  $R > 99.8\%$ ; HT @  $808 \text{nm}$ ,  $T < 0.5\%$Different coating specification upon customer request.

### Typical Specification and Tolerance:

- 1) Angle tolerance:  $\Delta\theta < \pm 0.2^\circ$ ;  $\Delta\varphi < \pm 0.2^\circ$
- 2) Dimension tolerance:  $(W \pm 0.1 \text{mm}) \times (H \pm 0.1 \text{mm}) \times (L + 0.2 \text{mm}/-0.1 \text{mm})$
- 3) Flatness:  $\lambda/8$  @  $633 \text{nm}$
- 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:  $< \lambda/8$  @  $633 \text{nm}$
- 8) Clear aperture:  $> 90\%$  central area



## LBO nonlinear crystal

LBO ( $\text{LiB}_3\text{O}_5$ )\* is a nonlinear optical crystal perfectly suited for harmonic generation as well as sum frequency mixing and OPO applications using widely spread Nd lasers, Ti:Sapphire and Dye lasers. Such physical LBO properties as excellent optical homogeneity, non hygroscopicity and very high damage threshold assure long and stable operation of crystal. LBO crystal is the first choice as harmonic generator of high peak power pulsed lasers.

JYS can provide large aperture LBO crystals which can be used for harmonic generation and OPO of high average/peak power Q-switched Neodymium lasers, where other crystals can't withstand. Non-critical phase matching in wide range achievable by temperature tuning allows to employ long crystals without any walk-off influence on nonlinear interaction efficiency. Especially this application is attractive for CW and quasi-CW lasers.

LBO crystals specification:

Width and height: Max 15 x 15 mm

Length: Max 18mm

Flatness:  $\lambda/6$  at 633 nm

Parallelism < 10 arcsec

Surface quality: 10/5 scr/dig as per MIL-O-13830A

Perpendicularity: < 5 arcmin

Angle tolerance : < 15 arcmin

Clear aperture: 90% of full aperture

## Diode Pumped Laser Crystal Microchip

Diode-Pumped Solid State (DPSS) lasers are the ideal laser material for pointing light shows, machining, material processing, spectroscopy, wafer inspection and medical diagnostics etc..JYS's Diode-Pump Microchip (DPM) crystal assemblies combine Nd: YVO4 and KTP and act as the laser core for green DPSS lasers. Applications for DPMs include green laser pointers, laser displays, DPSS green lasers and surveying laser systems.

### Suggested applications

Pump power for the low power DPM crystals is less than 300mW and the generated green output power can reach 10mW. Pump power for the middle power DPM crystals is less than 500mW and the generated green output power can reach 60mW. Pump power for the high power DPM crystals is less than 600mW and the generated green output power can reach 100mW. Heat deposit mechanics are needed.

Application  
Mini-Projector  
Display Laser  
DPSS Green Lasers  
Surveying Laser system  
Defence Laser System



### Feature

Output Power 532nm (mW): >40  
Conversion Efficiency: >20%  
Dimension: 2x2.5x2.5mm  
Polarization Ratio: >10:1  
Operating Temperature at crystal surface: 35-50  
Output Beam Quality: TEM00

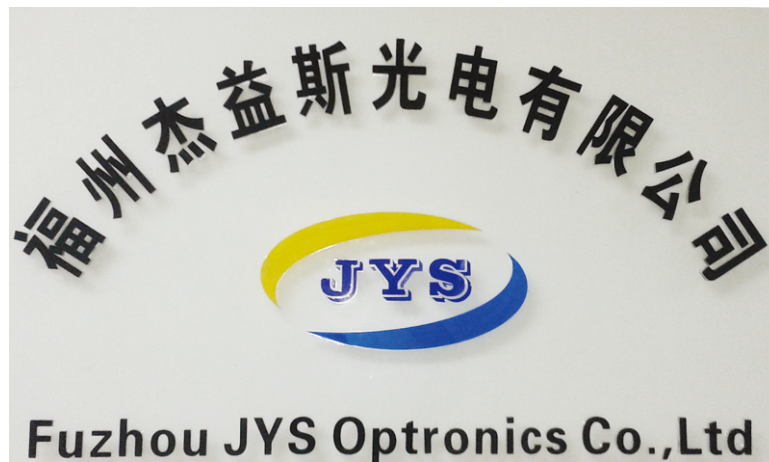
JYS can provide a wide variety of coatings from simple single layer AR coatings using MgF2 and mirror coatings to complex multilayer dielectric stacks. Typical types of dielectric coatings are BBAR, V-coatings, Dual wavelength AR coatings and HR coatings.



Coating Type		Properties and Application
Antireflection	Single Layer MgF2	Applied to materials with refractive indices from 1.45 to 2.4. The most popular antireflection coating for visible . They are insensitive to change in incidence angles.
	Multilayer V	Used to provide low reflectance with in a narrow durable wavelength band for most laser application. Minimum reflection can be less than 0.1 %
	Broadband Multilayer	These coatings have excellent performance over a broad spectral range broadband. Coating performance is sensitive to angle of incidence.
	Dual Wavelength Band	Offer very low reflectance at two widely spaced wavelengths, such as Nd:YAG Laser (1064) and its second harmonic (532) .
Partial Reflection	Narrow Band	Provide 50% reflection and transmission at an angle of 45 incidence for a single wavelength. Perfect for beamsplitters application. Transmission/reflection (T/R) ratio of 20/80, or others for Beamsplitter is available upon request.
	Broadband	Over a wide bandwidth provides 50% reflection and transmission. JYS can also provide coatings with different R/T ratios at and specific angle of incident.
Beamsplitter	Laser Line Polarization Beamsplitter	High reflection for s-polarized and antireflection for p-polarized for laser application.
	Broadband Polarization Beamsplitter	Wide wavelength bandwidth provide high reflection to s-polarized and antireflection to p-polarized
	Dichroic Beamsplitters Mirrors	These coatings can separate the laser fundamental and the pump wavelength, or the fundamental and the second harmonic. They are specific applied to laser mirrors.
High Reflection	Dielectric High Reflective Coatings	Provide high reflectance over a broad bandwidth, and is ideal for a tunable laser or in white light applications.
	Metallic High Reflective Coatings	Metallic coatings have low peak reflectance, mechanical durability and damage threshold, but they have extremely broadband and low cost. They are insensitivity to angle of incident light and polarization.



## Note



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