SinoCeramics

Optical Components:

Polarizing Optics

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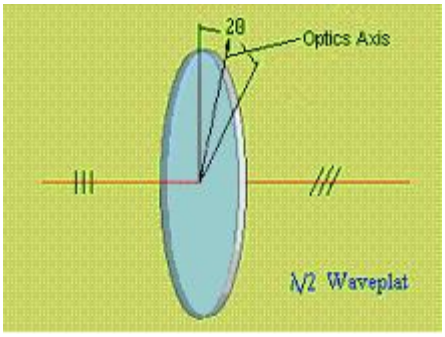
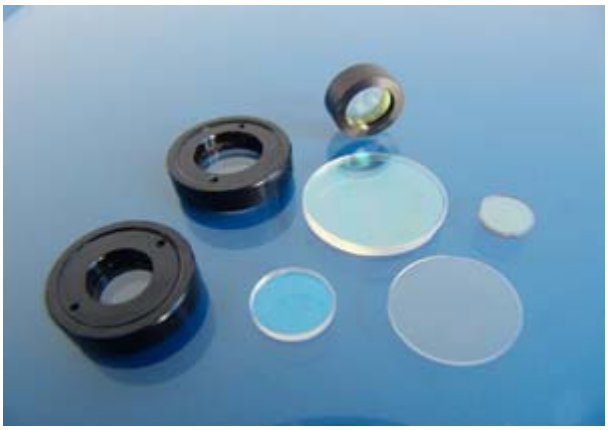
Wave Plates





Wave plates are made from birefingent material. The velocities of the extraordinary and ordinary rays that go through the birefingent material vary inversely with the refractive indices. The difference in velocity produces a phase difference when the two beams recombine. In the case of an incident linearly polarized beam, the phase difference is equal to $\delta = 2\pi d(n_e-n_o)/\lambda$. Notice that for any wavelength, the phase difference is controlled by the thickness of the wave plate.

Sinoceramics provides many kinds of wave plates, such as Low-order wave plates, cemented zero-order wave plates, airspaced zero-order wave plates, true zero-order wave plates and dual wavelength wave plates. Also we provide wave plates with different retardation as half-wave, quarter-wave, octadic-wave, and full-wave. If you want to order the specific retardation of wave plate for your system, Sinoceramics is able to design any type for the customer. High precision and mass production is available upon request. Sinoceramics also has a high precision wave plate-master, which can test wave plates with retardation tolerances < 1/600.

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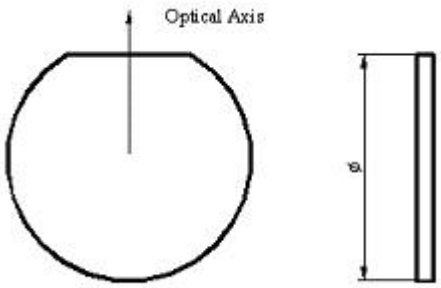
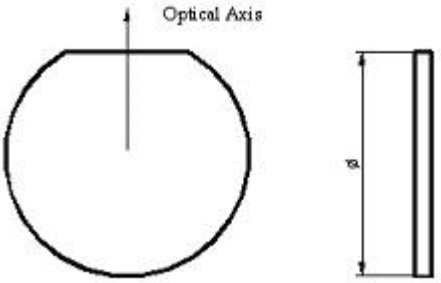
Multi Order Wave Plates

Specifications:
Material: Quartz Crystal
Diameter Tolerance: +0.0/-0.15mm
Parallelism: < 1 arc second
Surface Quality: 20-10 scratch and digs
Wavefront Distortion: < λ /10 @ 633nm
Retardation Tolerance: < λ /300
AR/AR Coating: R < 0.2% on both sides
Thickness: 0.5-1.0mm
Part Number: WPM



Low Order Wave Plates

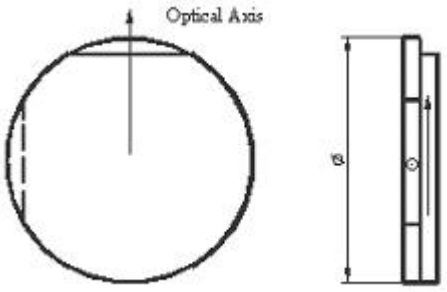
Specifications:
Material: Quartz Crystal
Diameter Tolerance: +0.0/-0.15mm
Parallelism: < 1 arc second
Surface Quality: 20-10 scratch and digs
Wavefront Distortion: < λ /10 @ 633nm
Retardation Tolerance: < λ /300
AR/AR Coating: R < 0.2% on both sides
Thickness: < 0.5mm
Part Number: WPL



	Part Number	
Diameter	Multi-Order	Low-Order
10.0mm	WPM5110	WPL5110
12.7mm	WPM5112	WPL5112
15.0mm	WPM5115	WPL5115
20.0mm	WPM5120	WPL5120
25.4mm	WPM5125	WPL5125

Cemented Zero Order Wave Plates

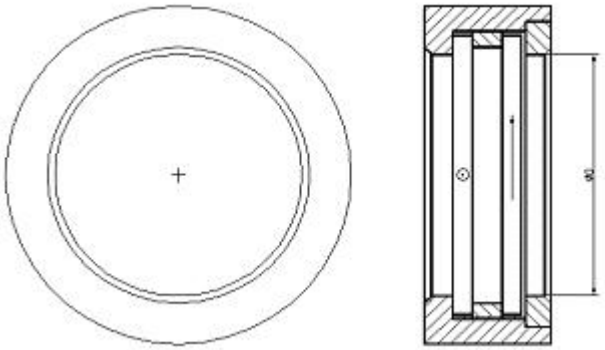
Specifications:
Material: Quartz Crystal
Diameter Tolerance: +0.0/-0.15mm
Parallelism: < 3 arc second
Surface Quality: 20-10 scratch and digs
Wavefront Distortion: < λ /10 @ 633nm
Retardation Tolerance: < λ /300
AR/AR Coating: R < 0.2% on both sides
Part Number: WPZ



Diameter	Part Number
10.0mm	WPZ5110
12.7mm	WPZ5112
15.0mm	WPZ5115
20.0mm	WPZ5120
25.4mm	WPZ5125

Airspaced Zero Order Wave Plates

Specifications:
Material: Quartz Crystal
Diameter Tolerance: +0.0/-0.15mm
Parallelism: < 1 arc second
Surface Quality: 20-10 scratch and digs
AR/AR Coating: R < 0.2% on both sides
Part Number: WPZ



Diameter	Part Number
10.0mm	WPZ5210
12.7mm	WPZ5212
15.0mm	WPZ5215
20.0mm	WPZ5220
25.4mm	WPZ5225

Ture Zero Order Wave Plates

Specifications:
Material: Quartz Crystal
Dimension: ±0.05mm
Parallelism: < 1 arc second
Surface Quality: 20-10 scratch and digs
Wavefront Distortion: < λ /10 @ 633nm
Orientation Tolerance: < 0.1°
Retardation: < λ /300
Chips: < 0.05mm
AR Coating: R < 0.2% @ special range

Sinoceramics provides true order quartz half wave plate using fiber optics. With this high precision wavelength, you can get wide Wavelength Bandwidth, Temperature Bandwidth and Incidence Angle Bandwidth. The specifications are as follows:

Wavelength	Retardation	Order	Thickness	Tolerance	Coating Range
1310nm	λ /2	Zero Order	0.076mm	± 0.51μm	1310nm ± 40nm
1485nm	λ /2	Zero Order	0.0871mm	± 0.58μm	1485 ± 40nm
1545nm	λ /2	Zero Order	0.0910mm	± 0.60μm	1520nm ± 40nm
1585nm	λ /2	Zero Order	0.0936mm	± 0.62μm	1565nm - 1610nm
1310nm	λ /2	Zero Order	0.1141mm	± 0.51μm	1310nm ± 40nm
1485nm	λ /2	Zero Order	0.1307mm	± 0.58μm	1485nm ± 40nm
1545nm	λ /2	Zero Order	0.2365mm	± 0.60μm	1520nm - 1565nm
1585nm	λ /2	Zero Order	0.1404mm	± 0.62μm	1565nm - 1610nm

Standard Sizes: 1x1mm, 2x2mm, 3x3mm, etc.

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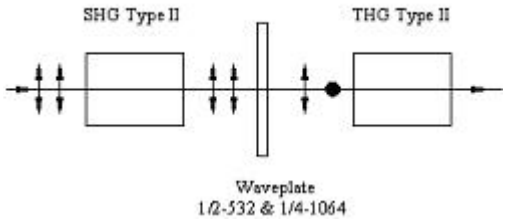
Dual Wavelength Wave Plates

Specifications:

Material: Quartz Crystal
Diameter Tolerance: +0.0/-0.15mm
Parallelism: < 1 arc second
Surface Quality: 20-10 scratch and digs
AR Coating: Dual wavelength AR coating on both sides
Part Number: WPD



Dual wavelength wave plates are widely used on Third Harmonic Generation systems (THG). When you need a NLO crystal for type II Second Harmonic Generation system (SHG) (o+e---e), and a NLO crystal for type II THG (o+e---e), the output polarization from the SHG can not be used for the THG. Dual wavelength wave plates work like polarizing rotators, they can rotate the polarization of one beam and keep another beam's polarization constant. Also the dual wavelength wave plate can be applied to the following systems:

1. Type II SHG + Type II THG
2. Type II SHG + Type I THG
3. Type I SHG + Type I THG

For example, if we use KTP as the SHG type II and LBO as the THG type II, the polarization of the output beam from the KTP is not optimized for the THG type II. However, when we use a dual wavelength wave plate (as seen in the drawing), it can change the 532nm beam to a special angle polarization but the 1064nm beam will remain constant.

Items	Diameter			
	10.0mm	12.7mm	15.0mm	20.0mm
	Part Number			
λ - 1064nm, λ /2 - 532nm	WPD5110	WPD5112	WPD5115	WPD5120
λ - 1064nm, λ - 532nm	WPD5210	WPD5212	WPD5215	WPD5220
λ /2 - 1064nm, λ /4 - 532nm	WPD5310	WPD5312	WPD5315	WPD5220
λ /4 - 1064nm, λ /2 - 532nm	WPD5410	WPD5412	WPD5415	WPD5420

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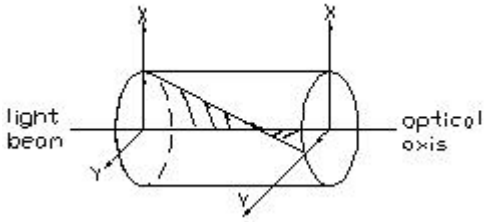
Polarization Rotator

Specifications:
Material: Quartz Crystal
Diameter Tolerance: +0.0/-0.15mm
Parallelism: < 10 arc second
Surface Quality: 20-10 scratch and digs
Rotation Tolerance: < 0.5°
AR Coating: R < 0.25%
Part Number: QPR



A plane of linear polarization light will be rotated by a quartz crystal due to the optical activity. Sinoceramics supplies our quartz polarization rotators for a wide variety of polarization applications.

Standard Wavelength(nm):248, 266, 355, 405, 488, 514, 532, 633, 780, 800, 850, 1064, 1310, 1550
Rotation Angle: 45°, 90°

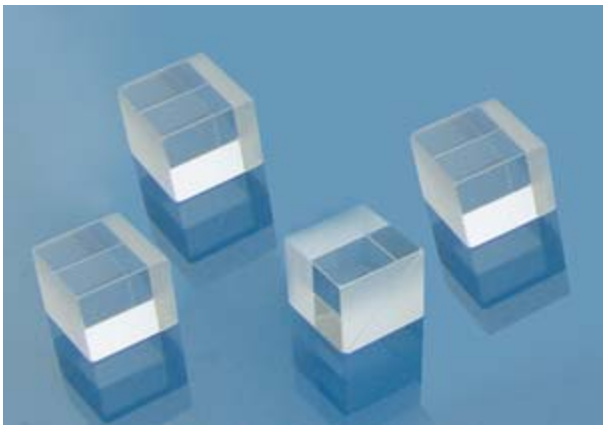
Part Number Information

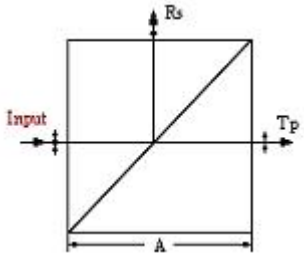
Part Number	QPR 5112-1064-90	QPR 51	12	1064	90
Information	Example Part Number	.	Size	Wavelength	Rotation Angle

Diameter	**Part Number**	
10.0mm	QPR5110-45	QPR5110-90
12.7mm	QPR5112-45	QPR5112-90
15.0mm	QPR5115-45	QPR5115-90
20.0mm	QPR5120-45	QPR5120-90
25.4mm	QPR5125-45	QPR5125-90

Polarization Beamsplitter

Specifications:
Material: BK7 Grade A
Dimension Tolerance: ± 0.1mm
Parallelism: < 3 arc min
Surface Quality: 20-10 scratch and digs
Flatness: λ /4 @ 633nm
Transmission: $T_p > 98\%$, $T_s < 0.5\%$
$R_s > 99.5\%$, $R_p < 2\%$
Extinction: > 400:1
AR Coating: R < 0.2% for all orthogonal surfaces

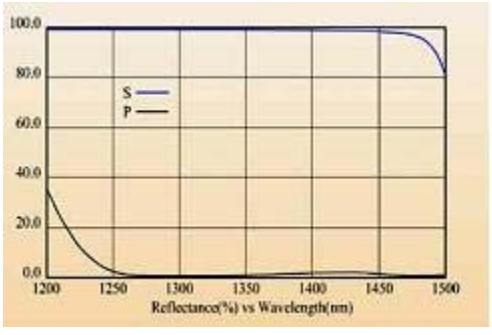


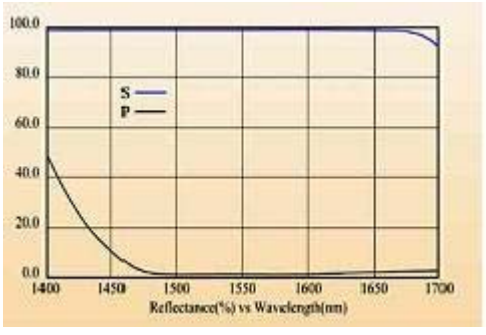


PBS prisms can divide natural light into two polarized lights. PBS prisms function as polarizers, beamsplitters, or beam combiners. The output beam's polarization which is parallel to the input beam is called a p-polarized beam, while the output beam's polarization that is orthogonal to the input beam is defined as a s-polarized.

Sinoceramics provides PBS for optic applications including the following specs:

Standard Sizes: 3.2x3.2x3.2mm, 5x5x5mm, 10x10x10mm, 12.7x12.7x12.7mm, 15x15x15mm, Standard Sizes: 20x20x20mm, and 25.4x25.4x25.4mm
Single Wavelength (nm): 355, 405, 488, 532, 633, 670, 780, 800, 850, 1064, 1310, 1550
Broad Band Wavelength (nm): 420-680, 650-900, 900-1200, 1200-1550





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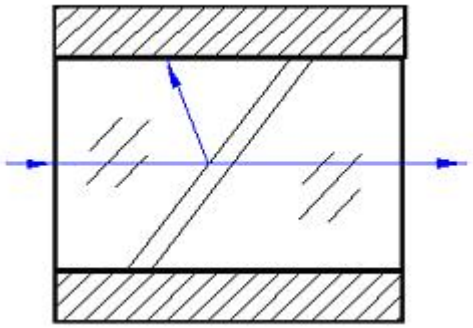
Glan Taylor Polarizer

Specifications:
Material: Calcite Crystal and a-BBO Crystal
Wavelength Range: 350-2300nm for Calcite
200-3500nm for a-BBO
Dimension Tolerance: ± 0.1mm
Surface Quality: 20-10 scratch and digs
Extinction Ratio: > 200,000:1
Coating: As Required
Housing: Black anodized aluminum



- Air space structure
- Maximum 2 Watts of CW power
- High polarization purity

Part Number	Material	Wavelength Range	Field Angle	Clear Aperture	Mounting Size
PGT7108	Calcite	350-2300nm	> 7.5 °	Diameter 8mm	Diameter 25.0x23.0mm
PGT7110				Diameter 10mm	Diameter 25.0x23.0mm
PGT7115				Diameter 15mm	Diameter 30.0x26.0mm
PGT9108	a-BBO	200-280nm	> 6°	Diameter 8mm	Diameter 25.0x23.0mm
PGT9110				Diameter 10mm	Diameter 25.0x23.0mm
PGT9115				Diameter 15mm	Diameter 30.0x26.0mm
PGT9208		300-2000nm	> 6°	Diameter 8mm	Diameter 25.0x23.0mm
PGT9210				Diameter 10mm	Diameter 25.0x23.0mm
PGT9215				Diameter 15mm	Diameter 30.0x26.0mm
PGT9308		700-3500nm	> 6°	Diameter 8mm	Diameter 25.0x23.0mm
PGT9310				Diameter 10mm	Diameter 25.0x23.0mm
PGT9315				Diameter 15mm	Diameter 30.0x26.0mm

Order Information

Part Number	PGT9215	PGT	9	2	15
Information	Example Part Number		Material	Series	Size

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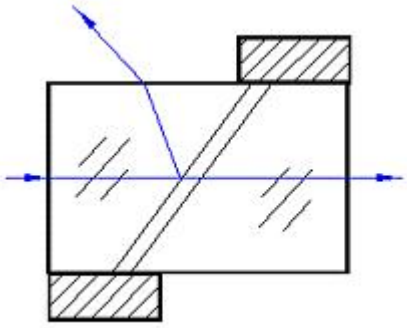
Glan Laser Polarizer

Specifications:
Material: Calcite Crystal and a-BBO Crystal
Wavelength Range: 350-2300nm for Calcite
200-3500nm for a-BBO
Dimension Tolerance: ± 0.1mm
Surface Quality: 20-10 scratch and digs
Extinction Ratio: > 200,000:1
Beam Deviation: < 3 arc minutes
Coating: As Required
Housing: Black anodized aluminum



- Air space structure
- Maximum 2 Watts of CW power
- High polarization purity

Part Number	Material	Wavelength Range	Field Angle	Clear Aperture	Mounting Size
PGT7108	Calcite	350-2300nm	> 7.5 °	Diameter 8mm	Diameter 25.0x26.0mm
PGT7110				Diameter 10mm	Diameter 25.0x28.0mm
PGT7115				Diameter 15mm	Diameter 30.0x35.0mm
PGT9108	a-BBO	200-280nm	> 6°	Diameter 8mm	Diameter 25.0x32.0mm
PGT9110				Diameter 10mm	Diameter 25.0x34.0mm
PGT9115				Diameter 15mm	Diameter 30.0x40.0mm
PGT9208		300-2000nm	> 6°	Diameter 8mm	Diameter 25.0x29.0mm
PGT9210				Diameter 10mm	Diameter 25.0x31.0mm
PGT9215				Diameter 15mm	Diameter 30.0x36.0mm
PGT9308		700-3500nm	> 6°	Diameter 8mm	Diameter 25.0x29.0mm
PGT9310				Diameter 10mm	Diameter 25.0x31.0mm
PGT9315				Diameter 15mm	Diameter 30.0x36.0mm

Order Information

Part Number	PGT9215	PGT	9	2	15
Information	Example Part Number	.	Material	Series	Size

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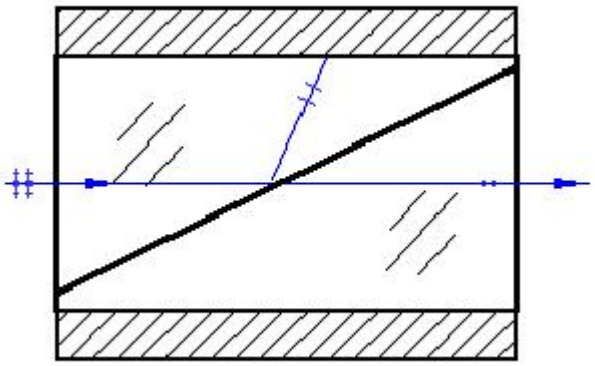
Glan Thompson Polarizer

Specifications:
Material: Calcite Crystal
Wavelength Range: 350-2300nm
Dimension Tolerance: ± 0.1mm
Surface Quality: 40-20 scratch and digs
Extinction Ratio: > 50,000:1
Beam Deviation: < 3 arc minutes
Housing: Black anodized aluminum



- Cemented structure
- Large acceptance angle

Part Number	Material	Wavelength Range	Field Angle	Clear Aperture	Mounting Size
PGS7108	Calcite	350-2300nm	> 14 °	Diameter 8mm	Diameter 25.0x33.0mm
PGS7110				Diameter 10mm	Diameter 25.0x33.0mm
PGS7115				Diameter 15mm	Diameter 30.0x45.0mm

Order Information

Part Number	PGS7110	PGS	7	1	10
Information	Example Part Number		Material	Series	Size

Material: 7 -- Calcite; 9--a-BBO
Serial: 1-- Standard Precision
Size: 08--dia 8mm; 10--dia 10mm; 15--dia 15mm

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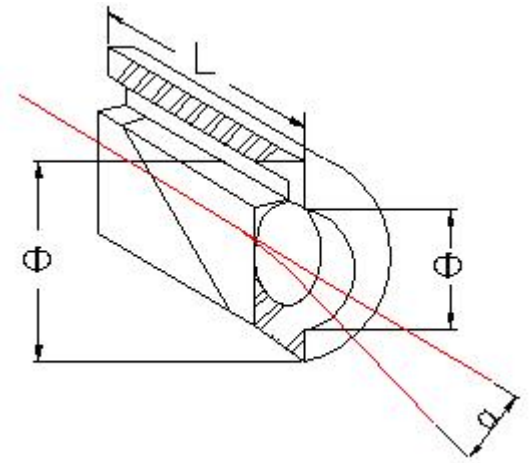
Rochon Polarizer

Specifications:
Material: a-BBO
Wavelength Range: 200-3500nm
Dimension Tolerance: ± 0.2mm
Surface Quality: 20-10 scratch and digs
Transmission Wavefront: λ /4 @ 632.8nm
Extinction Ratio: < $1x10^{-6}$
Transmission Efficiency: T > 95%
Coating: Protective coating on both surfaces



- Wide wavelength range
- High polarization purity
- High damaged threshold

Part Number	Beam Deviation	Field Angle	Clear Aperture	Mounting Size
PRH9108	8° @ 1064nm	> 6.9°	Diameter 8mm	Diameter 25.4x23.0mm
PRH9110			Diameter 10mm	Diameter 25.4x33.0mm
PRH9015			Diameter 15mm	Diameter 30.0x26.0mm

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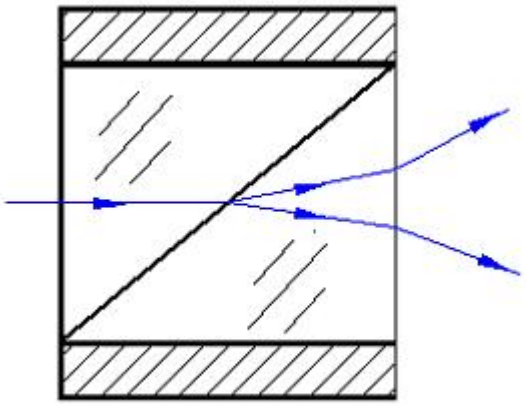
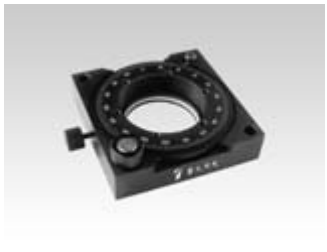
Wollaston Polarizer

Specifications:
Material: Calcite Crystal
Wavelength Range: 350-2300nm
Dimension Tolerance: ± 0.1mm
Surface Quality: 40-20 scratch and digs
Extinction Ratio: > 50,000:1
Beam Deviation: < 3 arc minutes
Housing: Black anodized aluminum



Part Number	Material	Wavelength Range	Field Angle	Clear Aperture	Mounting Size
PWS7108	Calcite	350-2300nm	15° @ 633nm	Diameter 8mm	Diameter 25.0x20.0mm
PWS7110				Diameter 10mm	Diameter 25.0x22.0mm
PWS7115				Diameter 15mm	Diameter 30.0x26.0mm

Rotatable Mounts for Polarizers

	Part Number	Dimension	Assembly Size	Clear Aperture
	7SRM156	Dia 56x29mm	Dia 29	Dia 25mm
	7SRM173	Dia 73x32mm	M 27mm	Dia 25mm
	7SRM329	Dia 29x12mm	M 14mm	Dia 12mm
	7SRM490	89x89x20mm	M 52mm	Dia 45mm

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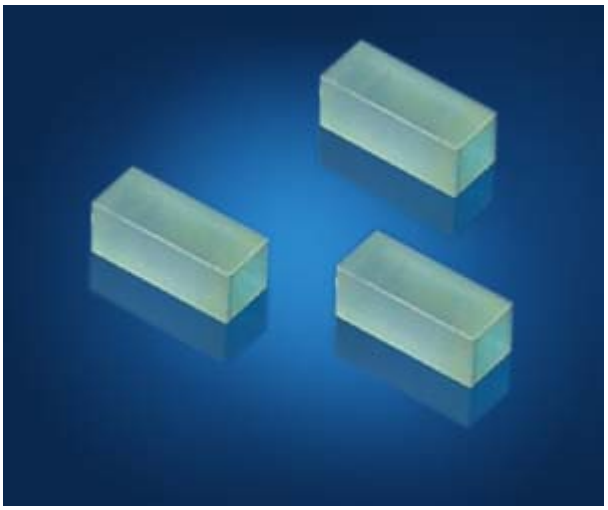
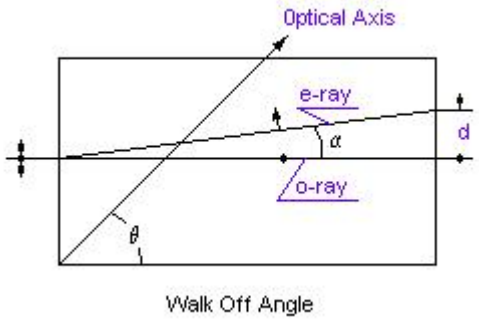
Beam Displacer



Specifications:
Material: YVO_4
Dimension Tolerance: ± 0.05mm
Optical Axis Orientation: ± 0.5°
Parallelism: < 15 arc sec
Perpendicularity: < 10 arc min
Flatness: λ /4 @ 633nm
Surface Quality: 60-40
AR Coating: R < 25% @ 1550 ± 40nm
AR Coating: or other wavelength

Based on the birefringence performance of YVO_4, a Beam Displacer can divide a beam into o-rays and e-rays. When a natural beam transmits through a birefringent crystal, the beam divides into two rays. One ray transmits through the crystal in a strait path, this ray is called the ordinary ray (o-ray). the other ray is transmitted through the crystal, but changes its direction. This ray is called the extraordinary ray (e-ray). The angle between the o-ray and the e-ray is called the walk off angle α. It is given by:
$\alpha = tg^{-1}(n_o^2/n_e^2 * tg\theta)-\theta$.
θ is the angle between the light beam and the optical axis



Walk Off Angle

Part No.	Material	Size	d	θ	φ	Coating
BDP6507	YVO_4	2.6x2.6x7.0mm	0.70mm	45°	0°	AR/AR @ 1550 ± 40nm
BDP6510	YVO_4	2.6x2.6x10mm	1.00mm	45°	0°	AR/AR @ 1550 ± 40nm
BDP6512	YVO_4	2.6x2.6x12mm	1.20mm	45°	0°	AR/AR @ 1550 ± 40nm
BDP6515	YVO_4	2.6x2.6x15mm	1.50mm	45°	0°	AR/AR @ 1550 ± 40nm

(d is the distance between o-ray and e-ray)