**Waveplate** is an optic 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 with various thickness. The phase shift is called retardance. The most popular retarders in Photonchina 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.

Photonchina's waveplate can transmit light and modify its polarization state without attenuating, deviating, or displacing the beam.It is ideal for applications requiring high damage thresholds and retardation stability over temperature change, such as for use with lasers or infrared light sources.

## Production

Photonchina's waveplates fabrication starts from quartz materials cutting with their axes oriented within a few arcminutes before being polished to a laser-quality finish, arcsecond parallelism, and <λ/10 wavefront. Their thickness tolerance is a only small fraction of a micron. To verify retardation tolerances, specially-trained optical technicians use purpose-built test gear. After anti-reflective coating, zero order and achromatic waveplates are matched in pairs and accurately aligned to each other within their cell mounts.

## Wavepalte Types:

### Half waveplate

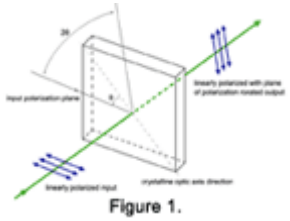

Figure 1.

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.

### Quarter Waveplate

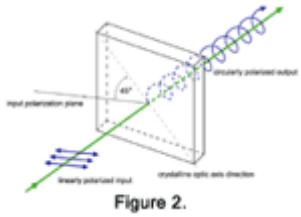

Figure 2.

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.

The thickness of the quarter waveplate is such that the phase difference is 1/4 wavelength ( λ /4, Zero order) or certain multiple of 1/4-wavelength [(2n+1)λ /4, multiple order].

Photonchina provides standard waveplate wavelengths (nm) listed as below:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 355 | 532 | 632.8 | 808 | 850 | 980 | 1064 | 1310 | 1480 | 1550 | 1590 |

Other wavelengths within the ranger of 200-2300nm are also available.

**Photonchina Standard Specifications:**

Material: Crystal Quartz

Dimension tolerance: +0.0, -0.1mm

Wavefront distortion: < λ /8@632.8

Retardation tolerance: < λ /500

Wavelength range: 240-2100 nm

Parallelism: <1 arc second

Surface quality: 20/10 scratches and dig

Clear aperture: >90%

AR coating: R<0.2% at central wavelength

Standard Wave: quarter-wave ( λ /4), half-wave ( λ /2)

## Low Order Waveplate

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 find use in many applicatios where the increased sensitivities are not an important.

Specifications:

| | |
|---|---|
| Material: | Quartz |
| Wavelength Range: | 200～2300 nm, |
| Dimension Tolerance: | +0.0, -0.1mm |
| Surface Quality: | 20 / 10 |
| Parallelism: | <1 arc Sec |
| Wavefront Distortion: | < λ/8@633nm |
| Retardation Tolerance: | < λ/300 |
| Clear Aperture: | >90% |
| Damage Threshold: | >500 MW/cm2 |
| AR Coating: | R<0.2%@wavelength |
| Mount: | Black Anodized Aluminium |

# 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 low/multiple order waveplates. It has broad bandwidth and a lower sensitivity to temperature and wavelength changes. It should be considered for more critical applications。

It is constructed of two low 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. There are normally three different structures as follows,

Optical Contact

Cemented by Epoxy

Air spaced

Specifications:

| | |
|---|---|
| Material: | Quartz |
| Wavelength Range: | 200～2300 nm, |
| Dimension Tolerance: | +0.0, -0.1mm |
| Surface Quality: | 20 / 10 |
| Parallelism: | <1 arc Sec |
| Wavefront Distortion: | < λ/8@633nm |
| Retardation Tolerance: | < λ/500 |
| Clear Aperture: | >90% |

Damage Threshold:

Air spaced, >500 MW/cm2;

Optical contact, >200 MW/cm2;

Cemented, >100 MW/cm2

| | |
|---|---|
| AR Coating: | R<0.2%@wavelength |
| Mount: | Black Anodized Aluminium |

True Zero Order Waveplate

Specifications:

| | |
|---|---|
| Material: | Quartz |
| Wavelength Range: | 200～2300 nm, |
| Dimension Tolerance: | +0.0, -0.1mm |
| Surface Quality: | 20 / 10 |
| Parallelism: | <1 arc Sec |
| Wavefront Distortion: | < λ/8@633nm |
| Retardation Tolerance: | < λ/500 |
| Clear Aperture: | >90% |

Damage Threshold

High power, >1 GW/cm2;

Single plate, >1 GW/cm2;

Cemented, >10 MW/cm2;

| | |
|---|---|
| AR Coating: | R<0.2%@wavelength |
| Mount: | Black Anodized Aluminium |

## 1.High Power Waveplate

High power:>10J/cm2@1064nm,20ns,20Hz.

Used wavelength:400-3000nm

Epoxy free

Easy handling compared with single plate

Wide spectra&temperature bandwidth,angular field

Structure: BK7/K9 glass + Quartz plate/MgF2 plate, unique optical bonding technique.

## 2. Single Plate

This type of zero order waveplate is designed for high damage threshold applications (> 1GW/cm2).

It is made of a very thin quartz,with the thickness of 0.038mm

Wide Angle Acceptance

Better Temperature Bandwidth

Wide Wavelength Bandwidth

Standard Wavelength:

1/2: 1310nm, 1480nm, 1550nm

1/4: 980nm, 1064nm，1310nm, 1480nm, 1550nm

3. Cemented

This type of zero order waveplate is constructed of one true zero order waveplate and one BK7/K9 substrate.

As the waveplate is very thin and easy to be damaged,the BK7 plate’s function is to strengthen the waveplate.

Standard Thickness:1.1±0.2mm

Cemented by Epoxy

Wide Angle Acceptance

Better Temperature Bandwidth

Wide Wavelength Bandwidth

Standard wavelength:

532nm, 632.8nm, 780nm, 808nm, 980nm, 1064nm, 1310nm, 1480nm, 1550nm

# Achromatic Waveplate

Achromatic waveplate is made from two different substrate materials such as crystal quartz and magnesium fluoride. For the single material,waveplate’s working wavelength is very limited because of the dispersion of the material. But Achromatic Waveplate uses two different kinds of materials,with the different dispersion, such waveplate is not sensitive to the wavelength change.

Specifications:

| | |
|---|---|
| Material: | Quartz and MgF2 |
| Dimension Tolerance: | +0.0, -0.1mm |
| Surface Quality: | 40 / 20 |
| Parallelism: | <1 arc Sec |
| Wavefront Distortion: | < λ/8@633nm |
| Retardation Tolerance: | < λ/100 |
| Clear Aperture: | >90% |
| Damage Threshold: | >10MW/cm2; |
| AR Coating: | Ravg<1.5%@wavelength |
| Structure: Optical contact or Air contacted | |

Standard wavelength:

460-650nm, 550-750nm, 650-1000nm, 900-2100nm.

# Dual Wavelength Waveplate

Dual wavelength waveplate is a special type of multiple waveplate that provides a specific retardance at two different wavelengths, it’s particularly useful when used in conjunction with other polarization sensitive components to separate coaxial laser beams of different wavelength. It is widely used to improve conversion efficiency in solid double frequency laser device.

Specifications:

| | |
|---|---|
| Material: | Quartz |
| Wavelength Range: | 350～2100 nm, |
| Dimension Tolerance: | +0.0, -0.1mm |
| Surface Quality: | 20 / 10 |
| Parallelism: | <1 arc Sec |
| Wavefront Distortion: | < λ/8@633nm |
| Retardation Tolerance: | < λ/100 |
| Clear Aperture: | >90% |
| Damage Threshold: | >1GW/cm2 |
| AR Coating: | R<0.2%@wavelength |
| Mount: | Black Anodized Aluminium |

Standard wavelength:

λ@1064nm+λ/2@532nm, λ/2@1064nm+λ@532nm;

λ@532nm+λ/2@355nm, λ/2@532nm+λ@355nm

# Polarization Rotator

Due to the rotation activity of natural quartz crystal, it also can be used as polarization rotators so that the plane of input linearly polarized beam will be rotated at special angle which is determined by the thickness of quartz crystal.

Made of quartz, 200-2500nm

Up to 50.8mm diameter

Custom rotation angle available

RoHS Compliant

Specifications:

| | |
|---|---|
| Material: | Crystal Quartz 200-2500nm |
| Dimension Tolerance: | +/-0.2mm |
| Surface Quality: | 20 / 10 |
| Parallelism: | <10 arc Sec |
| Wavefront Distortion: | < λ/4@632.8nm |
| Rotation accuracy: | < 5 arc Min |
| Rotation: | clockwise or counter-clockwise |
| Damage Threshold: | >1GW/cm2 |
| AR Coating: | R<0.25%@wavelength |