

# Yttrium Vanadate (YVO<sub>4</sub>) Crystal

## Introduction

The Yttrium Orthovanadate (YVO<sub>4</sub>) is a positive uniaxial crystal grown with Czochralski method. It has good temperature stability and physical and mechanical properties. It is ideal for optical polarizing components because of its wide transparency range and large birefringence. It is an excellent synthetic substitute for Calcite (CaCO<sub>3</sub>) and Rutile (TiO<sub>2</sub>) crystals in many applications including fiber optic isolators and circulators, interleavers, beam displacers and other polarizing optics ( refer to Table 1).

**Table 1. Comparison of basic properties between YVO<sub>4</sub> and other Birefringent Crystals**

		YVO <sub>4</sub>	TiO <sub>2</sub>	CaCO <sub>3</sub>	LiNbO <sub>3</sub>
Thermal Expansion (/°C)	c-axis	11.4x10 <sup>-6</sup>	9.2x10 <sup>-6</sup>	26.3x10 <sup>-6</sup>	16.7x10 <sup>-6</sup>
	a-axis	4.4x10 <sup>-6</sup>	7.1x10 <sup>-6</sup>	5.4x10 <sup>-6</sup>	7x10 <sup>-6</sup>
Refractive Index	n <sub>o</sub>	1.9447@1550nm	2.454@1530nm	1.6346@ 1497nm	2.2151@ 1440nm
	n <sub>c</sub>	2.1486@1550nm	2.710@1530nm	1.4774@ 1497nm	2.1413@ 1440nm
Birefringence (n <sub>c</sub> -n <sub>o</sub> )		0.2039@1550nm	0.256@1530nm	-0.1572@ 1497nm	-0.0738@ 1440nm
Mohs Hardness		5	6.5	3	5
Deliquescence		None	None	Weak	None
Transparency Range		0.4-5μm	0.4-5μm	0.35-2.3μm	0.4-5μm

## A reliable supplier of YVO<sub>4</sub> crystals

CASTECH is one of the earliest companies who have mastered the advanced growth technique of YVO<sub>4</sub> crystal. Now CASTECH has completed its strong mass-production line that can provide:

- Various size of bulk and finished high quality YVO<sub>4</sub> crystals up to φ35x50mm<sup>3</sup> and φ20x20mm<sup>3</sup>, respectively;
- Large quantity YVO<sub>4</sub> wedges and displacers used for fiber optical isolators and circulators, interleavers, in size of 1.25x1.25x0.5mm<sup>3</sup> to 3x3x15mm<sup>3</sup> to meet OEM customer's requirement;
- Quick delivery;
- Very competitive price;
- Strict quality control;
- Technical support;

### Basic Properties of YVO<sub>4</sub> crystal

Transparency Range:	High transmittance from 0.4 to 5μm
Crystal Symmetry:	Zircon Tetragonal, space group D <sub>4h</sub>
Crystal Cell:	a=b=7.12Å; c=6.29Å
Density:	4.22 g/cm <sup>3</sup>

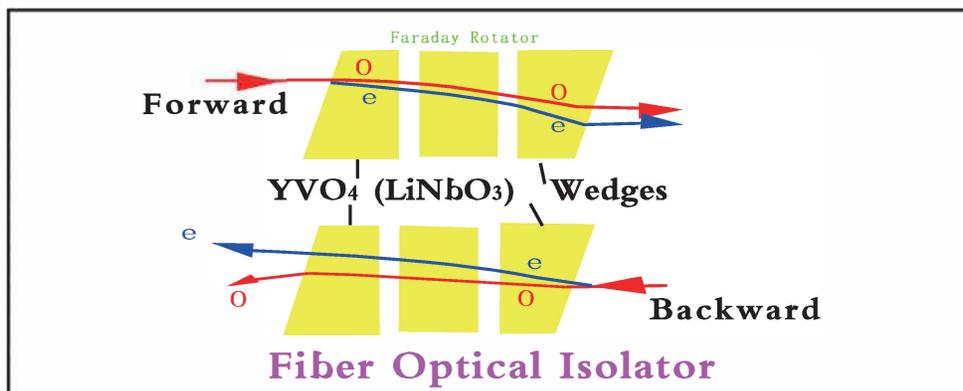
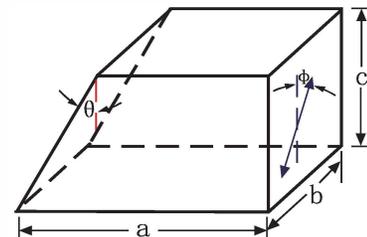
Mohs Hardness:	5, glass-like
Hygroscopic Susceptibility:	Non-hygroscopic
Thermal Expansion Coefficient:	$\alpha_a = 4.43 \times 10^{-6}/K$ ; $\alpha_c = 11.37 \times 10^{-6}/K$
Thermal Conductivity Coefficient :	//C: 5.23 W/m/K; $\perp$ C: 5.10 W/m/K
Crystal Class:	Positive uniaxial with $n_o=n_a=n_b$ , $n_c=n_e$
Thermal Optical Coefficient:	$dn_a/dT = 8.5 \times 10^{-6}/K$ ; $dn_c/dT = 3.0 \times 10^{-6}/K$
Refractive Indices, Birefringence ( $\Delta n = n_e - n_o$ ) and Walk-off Angle at 45° ( $\rho$ ):	$n_o = 1.9929$ , $n_e = 2.2154$ , $\Delta n = 0.2225$ , $\rho = 6.04^\circ$ at 630nm $n_o = 1.9500$ , $n_e = 2.1554$ , $\Delta n = 0.2054$ , $\rho = 5.72^\circ$ at 1300nm $n_o = 1.9447$ , $n_e = 2.1486$ , $\Delta n = 0.2039$ , $\rho = 5.69^\circ$ at 1550nm
Sellmeier Equation ( $\lambda$ in $\mu m$ ):	$n_o^2 = 3.77834 + 0.069736/(\lambda^2 - 0.04724) - 0.0108133\lambda^2$ $n_e^2 = 4.59905 + 0.110534/(\lambda^2 - 0.04813) - 0.0122676\lambda^2$

## YVO<sub>4</sub> crystal application

YVO<sub>4</sub> crystals are widely used in fiber-optic isolators, beam displacers and optical circulators, etc.

### 1.Specifications of birefringent wedges for fiber-optic isolators

Aperture	1.0 x 1.0 mm <sup>2</sup> to 4 x 4 mm <sup>2</sup>
Dimension Tolerance	+/-0.05mm
Wedge Angle Tolerance	+/-0.1°
Optical Axis Orientation	+/-0.5°
Flatness	$\lambda/4$ @ 632.8 nm
Surface Quality	20-10
AR-Coating	R<0.2% @1550 or 1310nm
Standard Size	1.25mmx1.25mmx0.5mm with 13° or 15° wedge, $\phi=22.5^\circ$

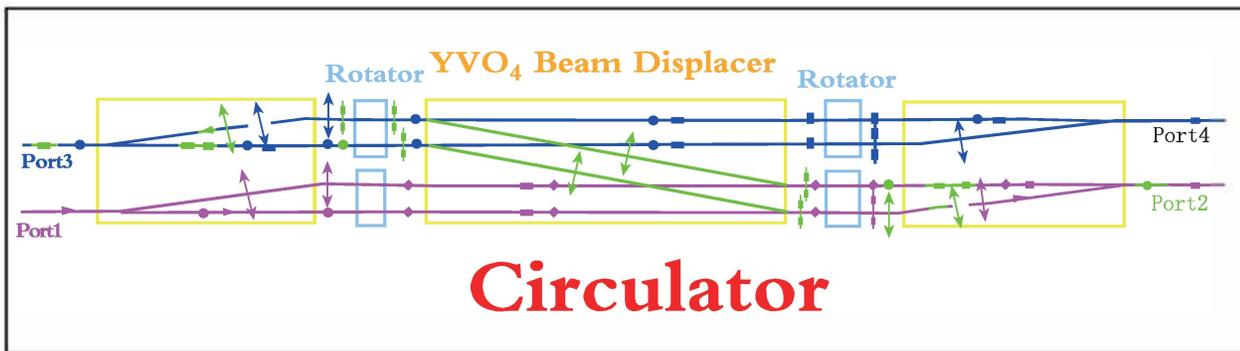




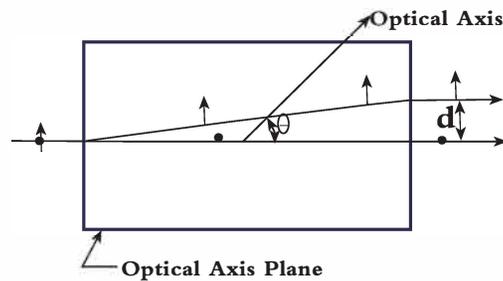
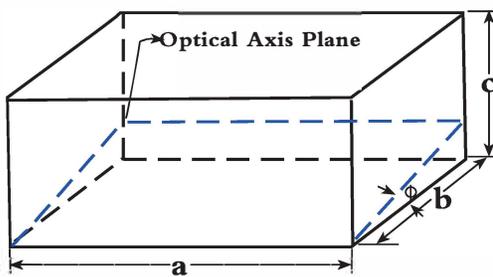
### Specifications of YVO<sub>4</sub> beam displacers for fiber-optic circulators or interleaver

Dimension Tolerance	W (±0.05mm)xH (±0.05mm) xL (±0.1mm)
Optical Axis Orientation	±0.5°
Parallelism	<15 arc sec
Perpendicularity	<10 arc min
Flatness	λ/4 @ 632.8 nm
Surface Quality	20/10
AR-Coating	R<0.2% @ 1550 nm or 1310nm ± 40 nm
Standard Size	2.6x2.6x10mm, θ=45°, φ=0°

Note: Other sizes and specifications are available upon request



YVO<sub>4</sub> Beam Displacer for Circulator



# 公司简介 INTRODUCTION



## CASTECH INC.

(CASTECH) was founded by Fujian Institute of Research on the Structure of Matter, Chinese Academy of Science in 1988. Thanks to long term interactive partnership with the leaders in laser system manufacturing industry and ongoing efforts of our employees, we have established the largest mass production lines in the world for LBO, BBO, Nd:YVO<sub>4</sub> and TGG crystals, and implemented a complete quality control system for our products.

CASTECH is now a worldwide leading supplier of nonlinear optical crystals, laser crystals, precision optics, and a variety of laser components. In CASTECH, there are Flux/Czochralski/Water Solution/Bridgman Crystal Growth production lines, Crystal Orientation and Dicing workshop, Optical Polishing workshop and Optical Coating workshop with IBS, IAD, MS and EB coating technique. Our commitments are backed by our huge manufacturing capacity.

CASTECH's quality system is IATF 16949:2016 and ISO 9001:2015 certified. We have established a complete system for outgoing parts inspection. Our optical testing equipments include Zygo Interferometers, Agilent Cary 7000, Perkin-Elmer Lambda 950, Nikon Microscope, Photo-Thermal Common-Path Interferometers, Zygo Newview 8300, Taylor Hobson LupoSan 260, Extinction Ratio Measurement and Ellipsometers. These equipments along with many others, ensure that we comply with all specifications for our products.

Today, over 60% of CASTECH's products are exported to USA, Japan, Europe and other Asia Market. We have established a global sales network. We have set up our agencies and distributors in the main industrial countries and districts.

Our mission is to deliver the best products and solutions to our customers in photonics industry, and help them to realize their full potential in business. Here at CASTECH, we value comity, integrity, honesty, and innovation.