

NONLINEAR OPTICAL CRYSTALS

Coherent is a global leader in the growth of high performance nonlinear crystals. We develop, design and manufacture advanced Nonlinear Optical Crystals (NLO) for a variety of uses in green, UVC and USP lasers. Our experienced growth and coating technology improves the conversion efficiency, laser damage threshold and overall life time.



MAJOR MATERIAL

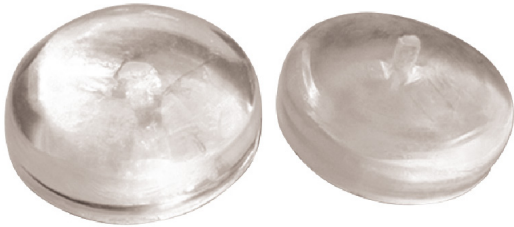
- BBO
- LBO
- KTP
- LiNbO₃

PRODUCTION CAPABILITY

- More than 100 growth stations
- Complete quality control
- 100 coating machines
- Diversified coating technology from IBS, E-beam, IAD and Magnetron sputtering

Beta-Barium Borate (β -BaB₂O₄, BBO) Crystals

Beta-Barium Borate (β -BaB₂O₄ or BBO) is an attractive non-linear optical crystal with a set of unique features, including wide transparency range from VUV to IR. Coherent supplies crystal lengths from 0.02mm to 25mm with various aperture and coating.



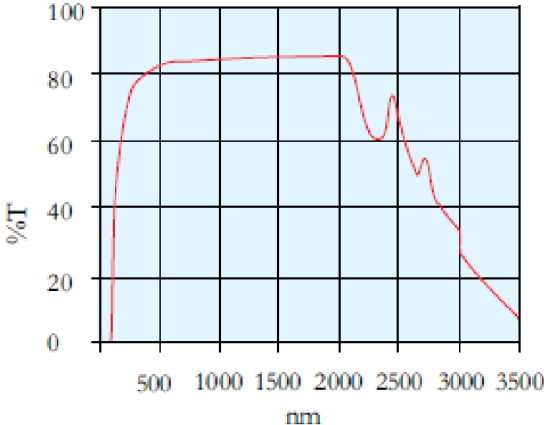
Key Features

- Broad transparency range from 190nm to 3.5 μ m
- Broad phase-matching range
- Relatively large effective SHG coefficient
- High damage threshold

Applications

- Second, third, fourth and fifth harmonic generation of Nd:YAG and Nd:YLF lasers
- Sum frequency of Dye, Argon, Ti:sapphire, and Alexandrite lasers
- OPO, OPA, OPCPA
- E/O switching for Pockels cells

BBO Transparency Curve



Specifications of BBO

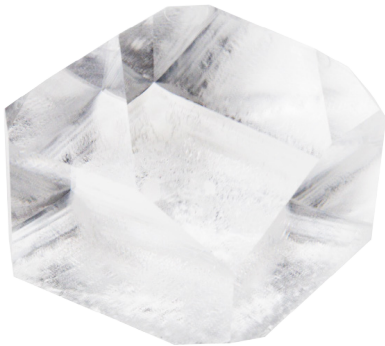
Parameter	Typical specified value
Size	Length from 0.2 mm to 25 mm
Dimension tolerance	0.05mm
Clear aperture	> 90% central area
Surface quality (scratch/dig)	Better than 10/5 MIL-O-13830A
Flatness	< $\lambda/10$ @633 nm
Transmitting wavefront distortion	< $\lambda/8$ @633 nm (length < 5 mm)
Parallelism	< 5 arc second
Perpendicularity	< 6 arc minute
Orientation	< ± 0.5 deg.
Coating	AR, BBAR, P-coatings
Adhesion and durability	Meets mil-c-48497a standards
Quality warranty period	One year under proper use

Lithium Triborate (LBO) Crystals

Coherent LBO is grown with an improved high temperature flux method. It includes the following unique features: wide transparency ranges from VUV to IR, high optical damage threshold, high effective non-linear coefficients, on-critical phase matching availability, and very small walk-off. Coherent supplies crystals with lengths from 0.02 mm to 20 mm and various aperture and coating.

Key Features

- Wide transparency range from 160nm to 2600nm
- High optical homogeneity ($dn \ll 10^{-6}/\text{cm}$) being free of inclusion
- Relatively large effective SHG coefficient
- Wide acceptance angle and small walk-off
- High damage threshold



Applications

- SHG and THG for solid state lasers (e.g. Nd:YAG, Nd:YLF lasers and Nd:YVO4 lasers, etc)
- Optical Parametric Amplifiers (OPA) and Optical Parametric Oscillators (OPO)

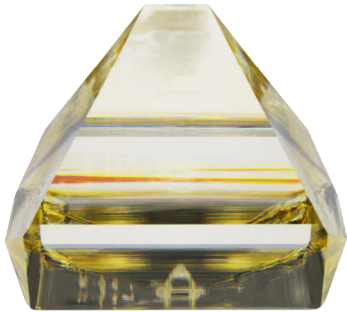
Specifications of LBO

Parameter	Typical specified value
Transmitting	wavefront distortion/8@633 nm (length < 5 mm)
Dimension tolerance	(W±0.05) × (H±0.05) × (L±0.05) mm
Clear aperture	> 90% central area
Flatness	< $\lambda/10$ @633 nm
Surface quality (scratch/dig)	Better than 10/5 MIL-O-13830A
Parallelism	< 5 arc second
Perpendicularity	< 6 arc minute
Orientation	< ±0.5
Coating type	AR coating @355 nm, 532 nm, 1 μm ; Others upon customer request
Adhesion and durability	Meets MIL-C-48497A standards
Quality warranty period	One year under proper use

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Potassium Titanyl Phosphate (KTiOPO₄, KTP) Crystals

Potassium Titanyl Phosphate (KTiOPO₄ or KTP) is widely used in both commercial and military lasers including laboratory and medical systems, range-finders, LIDAR, optical communication and industrial systems. Photop KTP crystal is grown with improved Flux growing technology and high purity chemical. It is featured with extreme low absorption at the fundamental and second harmonic generation wavelength.



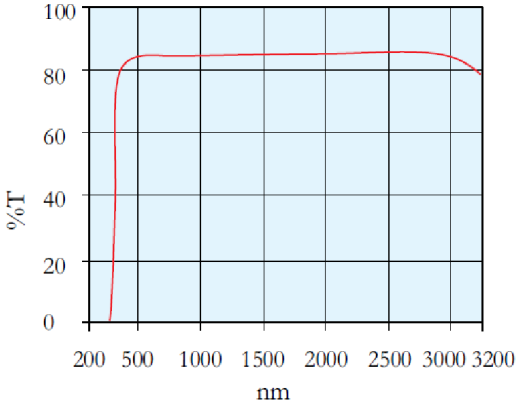
Key Features

- Large Nonlinear Optical (NLO) coefficient
- Wide angular bandwidth and small walk-off angle
- Broad temperature and spectral bandwidth
- High electro-optic coefficient and low dielectric constant
- Large figure of merit
- Nonhygroscopic, chemically and mechanically stable

Applications

- Frequency Doubling (SHG) of Nd-doped Laser for Green/Red output
- Parametric Source (OPO,OPG and OPA) for 600-4500nm Tunable Output
- E-O Modulators
- Optical Waveguides for Intergrated Optics and E-O devices

KTP Transparency Curve



Specifications of KTP

Parameter	Typical specified value
Transmitting	Wavefront distortion/8@633 nm (length < 5 mm)
Dimension tolerance	(W±0.05) × (H±0.05) × (L±0.05) mm
Clear aperture	> 90% central area
Flatness	< λ/8@633 nm
Surface quality (scratch/dig)	Better than 10/5 MIL-O-13830A
Parallelism	< 10 arc second (length < 10 mm), < 20 arc second (10 mm < length <20 mm)
Perpendicularity	< 12 arc minute
Orientation	< ±0.5 deg.
Coating type	According to the requirement of the client to coat AR or HR
Adhesion and durability	Meets MIL-C-48497A standards
Quality warranty period	One year under proper use

LiNbO₃ (LN) Crystals

LiNbO₃ (LN) Crystals

LiNbO₃ crystals combines low cost, good mechanical and physical properties as well as high optical homogeneity. Therefore, LiNbO₃ wedges have been widely used in fiber isolators and circulators. LiNbO₃ is also widely used as electro-optic modulators and Q-switches for Nd:YAG, Nd:YLF and Ti:Sapphire lasers as well as modulators for fiber optics.

Key Features

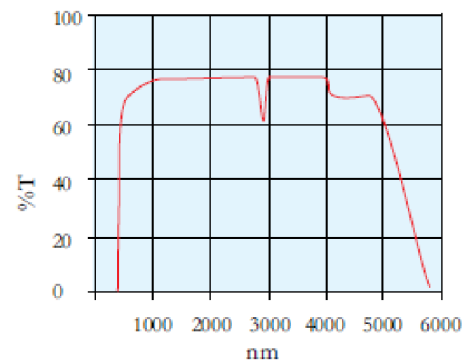
- Large Electro-Optic (E-O) and Acousto-Optic (A-O) coefficients
- High homogeneity
- Good mechanical and chemical stability
- Wide range transmittance
- Absorption loss < 0,1 %/cm @ 1064 nm

Applications

- Frequency doubling for wavelengths >1 μm and Optical Parametric Oscillators (OPOs) pumped at 1064 nm
- Quasi-Phase-Matched (QPM) devices
- Q-switches and modulators, Pockel cells and phase modulators
- Waveguide substrates, Surface Acoustic Wave (SAW) wafers

Crystal structure	Trigonal, space group R3c
Cell parameters	a = 0.515, c = 13.863, Z = 6
Melting point	1255 ± 5 °C
Curie point	1140 ± 5 °C
Mohs hardness	5
Density	4.64 g/cm ³
Absorption coefficient	≈ 0.1%/cm@1064nm
Solubility	Insoluble in H ₂ O
Relative dielectric constant	$\epsilon_{11}^T/\epsilon_0$: 85 $\epsilon_{33}^T/\epsilon_0$: 29.5
Thermal expansion Coefficients(@ 25°C)	// a, 2.0 × 10 ⁻⁶ /K // c, 2.2 × 10 ⁻⁶ /K
Thermal conductivity	38W / m /K@25 °C

LiNbO₃ Transparency Curve



Specifications of LiNbO₃

Parameter	Typical specified value
Size	Diameter up to 4 inch
Transmitting	Wavefront distortion/4~λ/8@633 nm depending on size
Dimension tolerance	(W±0.05) × (H±0.05) × (L±0.05) mm
Clear aperture	> 90% central area
Flatness	< λ/4@633 nm
Surface quality(scratch/dig)	Better than 10/5 MIL-O-13830A
Parallelism	< 10 arc second (length < 10 mm), < 30 arc second (10mm < length < 20 mm)
Perpendicularity	< 6 arc minute
Orientation	< ±0.5 deg.
Coating type	According to the requirement of the client to coat AR or HR films
Adhesion and durability	Meets MIL-C-48497A standards
Quality warranty period	One year under proper use