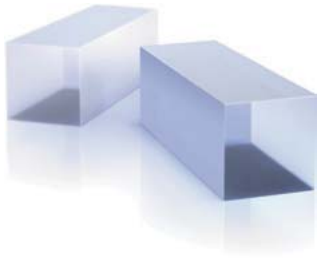
BBO Crystals



Description

Beta Barium Borate BBO is a non-linear optical crystal that combines a number of unique features.

These features of nonlinear BBO crystal include wide transparency and phase matching ranges, large non-linear coefficient, high damage threshold and excellent optical homogeneity. Therefore, BBO provides an attractive solution for various non-linear optical applications like OPO, OPA, OPCPA and other. As a result of large thermal acceptance bandwidth, high damage threshold and small absorption BBO is well suited for frequency conversion of high peak or average power laser radiation. The large spectral transmission range as well as phase matching, especially in UV range, makes BBO perfectly suitable for frequency doubling of Dye, Argon and Copper vapour laser radiation, effective cascade harmonic generation (Frequency doublers, triplers, parametric amplifiers and wave mixers) of wide spread Nd:YAG as well as of Ti:Sapphire and Alexandrite laser radiation. Both angle tuned Type 1 (oo-e) and Type 2 (eo-e) phase matching can be obtained increasing the number of advantages for different applications.

Features

- Broad phase-matchable second-harmonic-generation (SHG) range from 409.6 nm to 2500 nm
- Wide transparency range from 189 nm to 2600 nm
- Large effective SHG coefficient
- High damage threshold of 10 J/cm^2 for 10 ns pulse-width at 1064 nm
- Good mechanical and physical properties

Standard specifications

Transparency range	189-2600 nm
Dimensions tolerance	+0/-0.1 mm
Length tolerance	±0.1 mm
Orientation accuracy of cut angle	<30 arcmin
Surface quality	20-10 S-D after coating
Wavefront distortion	<λ/8 @ 632.8 nm
Parallelism error	<20 arcsec
Perpendicularity	<5 arcmin
Protective chamfers	<0.1 mm x 45°
Material optical damage threshold	>1 GW/cm^2 for 10 ns pulses @ 1064 nm

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LBO Crystals

Description

Lithium Triborate LBOs high damage threshold, wide acceptance angle, good thermal stability and wide transmission range make it ideal for frequency doubling of high power lasers.

It is unique in many aspects, especially its wide transparency range, moderately high non-linear coupling, high damage threshold and good chemical and mechanical properties. Its transmission range is from 0.16 µm to 2.6 µm. LBO allows temperature-controllable non-critical phase-matching operation (NCPM) for 1.0-1.3 µm , Type I SHG, and also provides room temperature NCPM for Type II SHG at 0.8-1.1 µm. It possesses a relatively large angular acceptance bandwidth, reducing the beam quality requirements for source lasers.

Features

- Broad transparency range from 160 nm to 2800 nm
- Relatively large effective SHG coefficient (about three times that of KDP)
- High damage threshold
- Wide acceptance angle and small walk-off
- Type I and Type II non-critical phase matching in a wide wavelength range

Standard specifications

Transparency range	160-2800 nm
Dimensions tolerance	+0/-0.1 mm
Length tolerance	±0.1 mm
Orientation accuracy of cut angle	<30 arcmin
Surface quality	20-10 S-D after coating
Wavefront distortion	<λ/8 @ 632.8 nm
Parallelism error	<20 arcsec
Perpendicularity	<5 arcmin
Protective chamfers	<0.1 mm x 45°
Material optical damage threshold	>1 GW/cm^2 for 10 ns pulses @ 1064 nm

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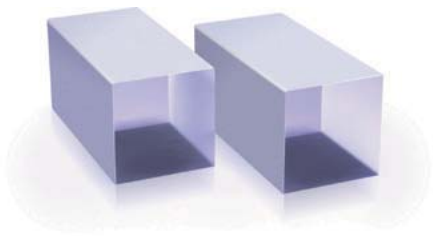
KTP Crystals



Description

Single crystal **Potassium Titanyl Phosphate** is an excellent non-linear crystal. KTP is a standard crystal with the parameters mostly used in extracavity configuration when a single pass through the crystal is required.

It exhibits high optical quality, broad transparency range, relatively high effective SHG coefficient (about 3 times higher than that of KDP), rather high optical damage threshold, wide acceptance angle, small walk-off and Type I and Type II non-critical phase-matching (NCPM) in a wide wavelength range. KTP is the most commonly used material for frequency doubling of Nd:YAG lasers and other Nd-doped lasers, particularly at the low or medium power density range.

Features

- Efficient frequency conversion and large non-linear optical coefficients
- Wide transmission region from 350 nm to 4400 nm
- Wide angular bandwidth and small walk-off angle
- Broad temperature and spectral bandwidth
- Low cost compared to BBO and LBO

Standard specifications

Transparency range	350-4400 nm
Dimensions tolerance	+0/-0.1 mm
Length tolerance	±0.1 mm
Orientation accuracy of cut angle	<30 arcmin
Surface quality	20-10 S-D
Wavefront distortion	<λ/8 @ 632.8 nm
Parallelism error	<20 arcsec
Perpendicularity	<5 arcmin
Protective chamfers	<0.1 mm x 45°
Material optical damage threshold	>500 MW/cm^2 for 10 ns pulses @ 1064 nm

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$AgGaSe_2$, $AgGaS_2$ Crystals

Description

$AgGaSe_2$ crystal has band edges at 0.73 and 18 µm. Its useful transmission range within 0.9–16 µm and wide phase matching capability provide excellent potential for OPO applications when pumped by a variety of currently available lasers. Tuning within 2.5–16 µm has been obtained when pumping by Ho:YLF laser at 2.05 µm; as well as non-critical phase matching (NCPM) operation within 1.9–5.5 µm when pumping at 1.4–1.55 µm. $AgGaSe_2$ has been demonstrated to be an efficient frequency doubling crystal for infrared CO_2 lasers radiation.

$AgGaS_2$ crystal is transparent from 0.53 to 12 µm. Although its nonlinear optical coefficient is lower among the other IR crystals, high short wavelength transparency edging at 550 nm is used in OPOs pumped by Nd:YAG laser; in numerous difference frequency mixing experiments with diode, Ti:Sapphire, Nd:YAG and IR dye lasers covering 2.4–12 µm range; in direct infrared countermeasure systems, and for SHG of CO_2 laser. Thin $AgGaS_2$ crystal plates are popular for ultrashort

wavelength pulses.

Features

- Large effective optical nonlinearity
- Wide spectral and angular acceptances
- Broad transparency range
- High figure of merit for non-linear interactions
- Ultrashort pulse generation in mid IR range
- Suitable for applications with CO_2 laser

Standard specifications

Transparency range	0.9-16 µm ($AgGaSe_2$)
	0.53-12 µm ($AgGaS_2$)
Dimensions tolerance	+0/-0.1 mm
Length tolerance	±0.1 mm
Orientation accuracy of cut angle	<30 arcmin
Surface quality	20-10 S-D
Surface flatness	<λ/4 @ 632.8 nm
Parallelism error	<40 arcsec
Perpendicularity	<5 arcmin
Protective chamfers	<0.1 mm x 45°
Material optical damage threshold	>350 MW/cm² for 10 ns pulses @ 1064 nm

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BSO Crystals

Description

Bismuth Silicon Oxide $Bi_{12}SiO_{20}$ is a pale yellow, photoconductive electro-optic crystal which has found increasingly wide application.

The strong spectral dependence of the photoconductive properties of these crystals and their electrooptic properties makes it possible to develop a wide variety of devices including spatial light modulators, electrooptic sensors, hologram recording devices, phase conjugation, photorefractive incoherent-to-coherent optical converters, pockels readout optical memory (PROM), thin film optical waveguides, photorefraction.

Features

- A wide variety of applications
- High phase conjugation efficiency
- Wide applications including pockels readout optical memory (PROM), thin film optical waveguides, photorefraction and phase conjugation
- Not soluble in water or organic solvents

Miscellaneous

- Custom design production is available
- Mass production available 500 pieces per month

Standard specifications

Transparency range	0.45-6 µm
Crystal symetry	Cubic, 23
Orientation	110 cut, 100 cut
Density	9.20 g/cm^2
Refractive index	2.54 @ 0.633 µm
Mohs hardness	5
Melting point	900°
Electrooptical coefficient	5.0 (r41) pm/V at 0.633 µm
Dielectric constant (low frequency)	56

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Fe:$LiNbO_3$ crystals

Description

Lithium Niobate crystals doped with iron Fe:$LiNbO_3$ are an excellent photorefractive material with high electro-optical coefficients and high photorefractive sensitivity and diffraction efficiency without an applied electric field. The crystals have wide applications in phase conjugation and holographic recording. Altechna offers crystals with different Fe doping concentration, dimensions and optical processing requirements.

Features

- A wide variety of applications, including optical laser device for writing a three dimensional hologram in the single crystal
- High phase conjugation efficiency
- Multi-domain structure
- High difraction efficiency

Miscellaneous

- Custom design production is available
- Custom dopant levels available
- Mass production available 500 pieces per month

Standard specifications

Transparency tange	0.35-5.5 μm
Crystal symetry	Trigonal, 3m
Density	4.64 g/cm^3
Mohs hardness	5
Melting point	1255
Refractive index at λ = 632.8 nm	n_o=2.29, n_e=2.2
Electrooptical coefficient at λ = 632.8 nm	r_{33}=32 pm/V, r_{22}=6.8 pm/V, r_{31}=10 pm/V
Dielectric constant (low frequency)	ε_{11}=85, ε_{33}=30

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KDP, DKDP Crystals

Description

Nonlinear single crystals **Pottasium Dideuterium Phosphate** KDP and DKDP are widely used as the second, third and fourth harmonic generators for Nd:YAG and Nd:YLF lasers.

These crystals are also widely used for electro-optical applications as Q-switches for Nd:YAG, Nd:YLF, Ti:Sapphire and Alexandrite lasers, as well as for Pockels cells. The most commonly used electro-optical crystal is DKDP with a deuteration ratio more than 98%. These crystals are grown by a water-solution method and can be grown up to very large sizes. Therefore, they are available as low-cost and large-size finished non-linear components.

For frequency-doubling (SHG) and -tripling (THG) of Nd:YAG laser at 1064 nm, both type I and type II phase-matchings can be employed with nonlinear single crystals KDP and DKDP. For frequency - quadrupling (FHG, output at 266 nm) of Nd:YAG laser KDP crystal is normally recommended.

Features

- Good UV transmission
- High optical damage threshold
- High birefringence
- Negative thermal lensing

Standard specifications

Transparency range	160-1800 (DKDP) nm
Dimensions tolerance	+0/-0.1 mm
Length tolerance	±0.1 mm
Orientation accuracy of cut angle	<30 arcmin
Surface quality	20-10 S-D
Surface flatness	<λ/4 @ 632.8 nm
Parallelism error	<20 arcsec
Perpendicularity	<5 arcmin
Protective chamfers	<0.1 mm x 45°
Material optical damage threshold:	>10 J/cm^2 for 10 ns pulses @ 1064 nm for KDP
	>5 J/cm^2 for 10 ns pulses @ 1064 nm for DKDP

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$LiNbO_3$ Crystals

Description

Lithium Niobate is widely used as frequency doubling crystal for wavelengths over 1 micron and optical parametric oscillators (OPOs) pumped at 1064 nm as well as quasi-phase-matched (QPM) devices.

$LiNbO_3$ is also one of the most attractive materials for optoelectronics. A great variety of devices has been developed based upon this material.

Altechna offers a lot of products made from high quality $LiNbO_3$ crystals of both acoustic and optical grades. Typically, Czochralsky grown along Z-axis boules are used with sizes up to 80 mm in diameter and 100 mm in length. Other boules orientations can be applied for some purposes (SAW substrates, piezotransducers).

Features

- High homogeneity
- Wide transparency range
- Unique electro-optical, photoeleastic, piezoelectric and nonlinear properties
- Good mechanical and chemical stability
- Absorption loss < 0,1%/cm @ 1064 nm

Standard specifications

Transparency range	350-5500 nm
Dimensions tolerance	+0/-0.1 mm
Length tolerance	±0.1 mm
Orientation accuracy of cut angle	<30 arcmin
Surface quality	20-10 S-D
Surface flatness	<λ/8 @ 632.8 nm
Parallelism error	<20 arcsec
Perpendicularity	<5 arcmin
Protective chamfers	<0.1 mm x 45°
Material optical damage threshold	>250 MW/cm² for 10 ns pulses @ 1064 nm

Contact Altechna for larger quantity pricing sales@altechna.com

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SBN Crystals

Features

- Very high quality crystals suitable for two- and four-wave mixing
- Perfect for electro-optical and acousto-optical applications
- Suitable for pyroelectrical applications
- Highly efficient phase conjugation
- All crystals could be poled and would have carbon-water electrodes

Miscellaneous

- Custom design production is also available

Description

Strontium-Barium Niobate is an excellent optical and photorefractive material.

Nominally pure and doped by Ce, Cr, Co, Fe SBN crystals of different compositions (SBN:61, SBN:75) are used in elecro-optics, acousto-optics, photorefractive non-linear optics. A new growing technique (Modified Stepanov technique) provides excellent optical quality single crystals, free of growth striations, inclusions and other inhomogeneities, as well as definite cross section and linear dimensions up to 100 mm. SBN crystalline elements meet the requirements for different applications. Based on this unique crystal growing technique, large high quality SBN optical elements and photorefractive cells are available.

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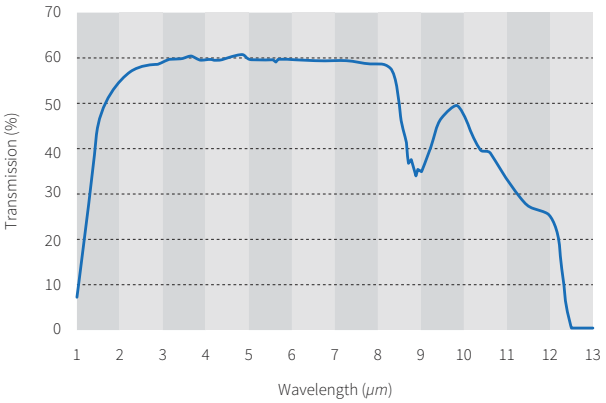
$ZnGeP_2$ Crystals

Transmission spectra of uncoated $ZnGeP_2$ crystal, 14 mm thickness



Description

Zinc-Germanium Diphosphide ($ZnGeP_2$, ZGP) single crystals are highly-effective non-linear optical crystals for the mid-IR as well as terahertz range. $ZnGeP_2$ crystals have positive birefringence which allows to carry out phasematched parametric frequency conversion of optical radiation in all the ranges of their background transparency spectrum from 0.75 to 12.0 μm. Its useful transmission range lies from 1.9 to 10.6 μm with absoprtion of lower than 0.05 cm^{-1} @ 2.05 μm. $ZnGeP_2$ has large non-linear optical coefficient and a relatively high laser damage threshold.

Features

- High damage threshold AR coatings available
- We consult our customers to obtain the optimal solution for IR applications

General properties of $ZnGeP_2$ crystals

Transparency range	0.75-12.0 μm
Point group	42 m
Density	4.12 g/cm³
Mohs hardness	5.5
Non-linear coefficient	d36 = 75.0 pm/V (at 9.6 μm)
Material optical damage threshold	80 MW/cm² 20 ns pulses @ 2.05 μm

Standard specifications

Transparency range	0.75-12 μm
Dimensions tolerance	+0/-0.1 mm
Length tolerance	±0.1 mm
Orientation accuracy of cut angle	<30 arcmin
Surface quality	20-10 S-D
Surface flatness	<λ/4 @ 632.8 nm
Parallelism error	<30 arcsec
Perpendicularity	<5 arcmin
Protective chamfers	<0.1 mm x 45°
Material optical damage threshold	80 MW/cm² 20 ns pulses @ 2.05 μm

Applications:

- Second, third, and fourth harmonic generation of CO_2 laser
- Optical parametric generation (OPO) with pumping at a wavelengths of 2.05-2.94 μm and possibility to generate effectively 3-10 μm ranges
- Second harmonic generation of CO-laser
- Producing coherent radiation in sub-millimetre-range from 70.0 μm to 1000 μm - terahertz range
- Generation of combined frequencies of CO_2 - and CO-lasers radiation and other lasers are working in the crystal transparency region

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