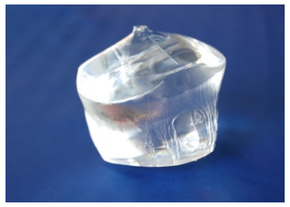
Crystals

BBO

Beta-Barium Borate (BBO) Crystals

BBO is a nonlinear optical crystal with combination of a number of unique features. Wide transparency and phase matching ranges, large nonlinear coefficient, high damage threshold and excellent optical homogeneity provide attractive possibilities for various nonlinear optical applications



Physical and Optical Properties

Crystal Structure	Trigonal, space group R_{3c}
Cell Parameters	a = b = 12.532Å, c = 12.717Å, Z = 6
Melting Point	1095 ±5°C
Transition Temperature	925±5°C
Optical Homogeneity	D n ≈10^{-6}/cm
Mohs Hardness	4.5
Density, (g/cm^3)	3.85 g/cm^3
Absorption Coefficient	< 0.1%/cm (at 1064 nm)
Hygroscopic Susceptibility	Low
Resistivity	> 10^{11}ohm/cm
Relative Dielectric Constant	e^T_{11}/e_0: 6.7, e^T_{33}/e_0: 8.1 Tan d , < 0.001
Thermal Expansion Coefficients(in the range of 25- 900°C)	⊥C, 4 x 10^{-6}/K; II c, 36 x 10^{-6}/K
Thermal Conductivity	⊥C, 1.2 W/m/K ; II c, 1.6 W/m/K
Transparency Range	189-3500nm
Therm-Optic Coefficients	D n_0/dT=-9. 3×10^{-6}/℃; dn_e/dT=-16. 6×10^{-6}/℃
NLO coefficients	d_{11} = 5.8 x d_{36}(KDP) d_{31} = 0.05 x d_{11}, d_{22}< 0.05 x d_{11}
Electro-Optic Coefficients	g_{11}= 2.7 pm/V, g_{22}, g_{31}< 0.1 g_{11}
Half-Wave Voltage	48KV (at 1064nm)
Flank Size(W*H)	1×1~15×15mm

Damage Threshold	@1.064um	5 GW/cm^2 (10 ns);10 GW/cm^2(1.3 ns)
	@0.532um	1 GW/cm^2 (10 ns);7 GW/cm^2(250 ps)
	@0. 266um	120MW/cm^2 (8 ns)
Sellmeier Equations		$n_0^2(\lambda)=2.7359+0.01878/(\lambda^2-0.01822)-0.01354\lambda^2$
		$n_0^2(\lambda)=2.3753+0.01224/(\lambda^2-0.01667)-0.01516\lambda^2$
Length(L)		0.005~20mm
Phase Matching Angle(θ, Φ)		Angel or according to customer request
Match Type		type I or type II
Angle Tolerance		Δθ<±0.2°; ΔΦ<±0.2°
Size Tolerance		(W ±0.1mm) x (H ±0.1mm) x (L +0.2mm/-0.1mm)
Flatness		< λ/8 @ 633nm
Smooth Finish		20/10
Parallelism		＜30”
Perpendicularity		＜10’
Wavefront Distortion		< λ/8 @ 633nm
Clear Aperture		> 90%
Coating		AR Coating or according to customer request

Standard BBO

Part No.	Dimension (mm)	theta (Deg)	phi (Deg)	Coating	Application
BBO6001	4. 0*4. 0*7. 0	22.8	0	AR/AR@1064&532nm	SHG@1064, Type I
BBO6002	4. 0*4. 0*7. 0	47.6	0	AR/AR@532&266nm	FHG@1064, Type I
BBO6003	4. 0*4. 0*10. 0	22.8	0	AR/AR@1064&532nm	SHG@1064, Type I
BBO6004	4. 0*4. 0*10. 0	47.6	0	AR/AR@532&266nm	FHG@1064, Type I
BBO6005	5. 0*5. 0*2. 0	29.2	0	AR/AR@800&400nm	SHG@800, Type I
BBO6006	5. 0*5. 0*1. 0	29.2	0	AR/AR@800&400nm	SHG@800, Type I
BBO6007	5. 0*5. 0*0. 3-0. 5	29.2	0	AR/AR@800&400nm	SHG@800, Type I
BBO6008	5. 0*5. 0*0. 1	29.2	0	AR/AR@800&400nm	SHG@800, Type I

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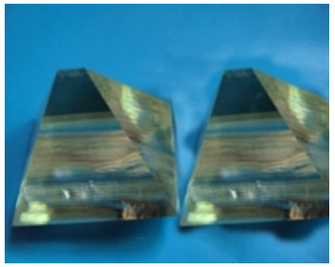
Crystals

KTP

KTP Crystals

KTP (KTiOPO4) is an excellent non-linear crystal. It exhibits high optical quality, broad transparent range, relatively effective SHG coefficient (about 3 times higher than that of KDP), very high optical damage threshold, wide acceptance angle, small walk-off , and type Ⅰ and type Ⅱ non-critial phase-matching (NCPM) in a wide wavelength range. KTP is the most commonly used material for frequency doubling of Nd:YAG laser and other Nd-doped lasers, particularly at the low or medium power density. The properties of KTP make it superior as an electro-optic modulator as well as an optical waveguide device, including phase modulators, amplitude modulators and directional couplers.



Crystal Structure	orthorhombic system, space group Pna21, point group mm^2
Cell Parameters	A=6.404Å, b=10.616Å, c=12.814Å, Z=8
Melting Point	About 1172 Degree
Mohs Hardness	~**5**
Density	3.01 g/cm^3
Thermal Conductivity	13W/m/K
thermal expansion coefficient	ax=11x10^{-6}/^{0}C, ay=9x10^{-6}/^{0}C, az=0.6x10^{-6}/^{0}C
Dialytic Wavebands	350~4500nm
SHG	497 ~ 1800nm (Type II)
Thermo-Optical Coeffecient(^{0}C)	dnx/dT=1.1X10^{-5}
	dny/dT=1.3X10^{-5}
	dnz/dt=1.6x10^{-5}
Absorption Coefficient	<0.1%/cm at 1064nm <1%/cm at 532nm
For Type II SHG of a Nd: YAG laser at 1064nm	Temperature Acceptance: 24°C-cm
	Spectral Acceptance: 0.56nm-cm
	Angular Acceptance: 14.2mrad-cm (Φ);55.3mrad-cm (θ)
	Walk-off Angle: 0.55°
Nonlinear Coefficient	d_{31}=6.5 pm/V d_{24}=7.6 pm/V
	d_{32}= 5 pm/V d_{15}=6.1 pm/V
	d_{33}=13.7 pm/V

Sellmeier Equation (λ in μm)	n_x^2=3.0065+0.03901/(λ^2-0.04251)-0.01327 λ^2
	n_y^2=3.0333+0.04154/(λ^2-0.04547)-0.01408 λ^2
	n_z^2=3.3134+0.05694/(λ^2-0.05658)-0.01682 λ^2
Flank Size(W*H)	1×1~15×15
Length(L):	0.05~20mm
Angle Tolerance:	Δθ<±0.2°; Δφ<±0.2°
Size Tolerance	(W±0.1mm) x (H±0.1mm) x (L + 0.2mm/-0.1mm)
Flatness	<λ/8 @ 633nm
Smooth Finish	20/10
Parallelism	＜30”
Perpendicularity	＜10’
Wavefront Distortion	< λ/8 @ 633nm
Clear Aperture	> 90%
Coating	According to customer request

Standard KTP

Part No.	Dimension（mm）	theta（Deg）	phi（Deg）	Coating	Application
KTP9001	3. 0*3. 0*5. 0	90	23. 5	AR/AR@1064&532nm	SHG@1064, Type II
KTP9101	3. 0*3. 0*5. 0	90	23. 5	HR/AR@1064&532nm	SHG@1064, Type II
KTP9002	3. 0*3. 0*10. 0	90	23. 5	AR/AR@1064&532nm	SHG@1064, Type II
KTP9102	3. 0*3. 0*10. 0	90	23. 5	HR/AR@1064&532nm	SHG@1064, Type II
KTP9003	5. 0*5. 0*10. 0	90	23. 5	AR/AR@1064&532nm	SHG@1064, Type II
KTP9004	7. 0*7. 0*5. 0	90	23. 5	AR/AR@1064&532nm	SHG@1064, Type II
KTP9205	7. 0*7. 0*20. 0	90	0	AR/AR@1573&1064nm	OPO@11573&1064nm

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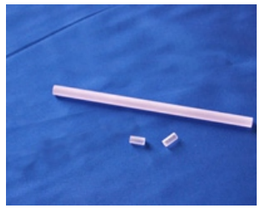
YAG

YAG Crystals

Nd:YAG (neodymium-doped yttrium aluminium garnet; Nd:Y3Al5O12) is a crystal that is used as a lasing medium for solid-state lasers. The dopant, triply ionized neodymium, typically replaces yttrium in the crystal structure of the yttrium aluminium garnet (YAG), since they are of similar size. Generally the crystalline host is doped with around 1% neodymium by atomic percent.



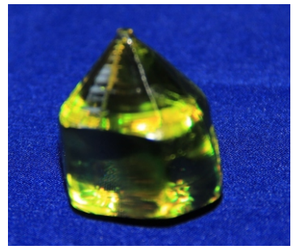
Applications

Nd:YAG absorbs mostly in the bands between 730760 nm and 790820 nm.At low current densities krypton flashlamps have higher output in those bands than do the more common xenon lamps, which produce more light at around 900 nm. The former are therefore more efficient for pumping Nd:YAG lasers

Nd Dopant Concentration	0.5-1.2 atm%tolerance within 10% of concentration
Diameter	3 ~ 14mm
Length(L)	0.5~160mm
Orientation	<111> crystalline direction (± 0.5℃)
Flatness	< λ/8 @ 633nm
Smooth Finish:	20/10
Parallelism	＜30"
Perpendicularity	＜10'
Wavefront Distortion	< λ/8 @ 633nm
Clear Aperture	> 90%
Coating	According to customer request
Chemical Formula	Nd:$Y_3A_{15}O_{12}$
Crystal Structure	Cubic
Lattice Constants	12.01Ä
Concentration	~ 1.2 x 10^{20} cm^{-3}
Melting Point	1970 °C
Density	4.56 g/cm^3
Mohs Hardness	8.5
Refractive Index	1.82
Thermal Expansion Coefficient	7.8 x 10^{-6} /K [111], 0 - 250 °C
Thermal Conductivity	14 W/m /K @20 °C, 10.5 W /m /K @100 °C.
Lasing Wavelength	1064 nm
Stimulated Emission Cross Section	2.8x10^{-19} cm^{-2}
Relaxation Time of Terminal Lasing Level	30 ns
Radiative Lifetime	550 ms
Spontaneous Fluorescence	230 m
Loss Coefficient	0.003 cm^{-1} @ 1064 nm
Effective Emission Cross Section	2.8 x 10^{-19} cm^2
Pump Wavelength	807.5 nm
Absorption band at pump wavelength	1 nm
Linewidth	0.6 nm
Polarized Emission	Unpolarized
Thermal Birefringence	High

YVO4

Yttrium Vanadate (Nd:YVO4) is one of the most efficient laser host crystal currently existing for diode laser-pumped solid-state lasers. Its large stimulated emission cross-section at lasing wavelength, high absorption coefficient and wide absorption bandwidth at pump wavelength, high laser induced damage threshold as well as good physical, optical and mechanical properties make Nd:YVO4 an excellent crystal for high power, stable and cost-effective diode pumped solid-state lasers. Recent developments have shown that Nd:YVO4 can produce powerful and stable IR, green, bule lasers with the design of Nd:YVO4 and frequency doubling crystals.



Nd Conentration	0.1%~3%
Flank Size	1*1~15*15
Long	0.2~20mm
Optical Axis Orientation:	A-cut
Dimension Tolerance	Commercial(±0.1mm)；High Precision(±0.005mm)
Surface Quality	20/10
Parallelism	＜30"
Optical Axis Orientation	± 0.2°
Chamfer	0.15×45°
Flatness	＜λ/8 @633nm
Wavefront Distortion	＜λ/8 @633nm
Coating	According to customer request
Atomic Density	1.26x1020 atoms/cm^3 (Nd 1.0%)
Crystal Structure	zircon Tetragonal, space group D4h-I4/amd a=b=7.1193, c=6.2892
Density	4.22g/cm^3
Mols	4-5 (Glass-like)
Thermal Expansivity (300K):	aa=4.43x10^{-6}/K ac=11.37x10^{-6}/K
Thermal Conductivity Coefficient (300K)	//C:0.0523W/cm/K ⊥C:0.0510W/cm/K
Laser Wave	1064nm, 1342nm ,914nm
Thermo-Optical Coeffecient (300K):	dn_o/d_T=8.5x 10^{-6}/K
	dn_e/d_T=2.9x 10^{-6}/K
Sellmeier Equation (for pure YVO4 crystals)	n_o^2=3.77834+0.069736/(λ²-0.04724)-0.0108133λ²
	n_e^2=4.59905+0.110534/(λ²-0.04813)-0.0122676λ²
Excited Emission Section	25x $10^{-19}$$cm^2$ @1064nm
Fluorescence Lifetime	90m s
Absorption Coefficient	31.4cm^{-1} @810nm
Extrinsic Loss	0.02cm^{-1} @1064nm
Gain Bandwidth	0.96nm @1064nm
Polarized Light Shoot	polarization; parallel to optic axis(c-axis)
LD Pump Light Throughput Efficiency	>60%