



DESCRIPTION

LBO crystal — the most excellent nonlinear crystal for Noncritical Phase Matched laser frequency doubling
LBO is one of the excellent non-linear crystals in the ultraviolet band. It has been successfully used in second and third harmonic generation of YLF, YAG, YAP lasers. LBO crystal has wide transmission band, good ultraviolet transmittance, slightly deliquescence, good physical and chemical properties, moderate non-linear optical coefficient, good optical uniformity, high damage threshold, large allowable angle and small walk-off angle. It has been widely used in high average power second harmonic, sum frequency, difference frequency, third harmonic, fourth harmonic and parametric oscillation field.

The greatest advantage of LBO is that temperature tuning can be used to achieve non-critical phase matching (NCPM). When the non-critical phase matching relationship is satisfied in the frequency doubling process, the walk-off angle between the fundamental frequency light and the second harmonic of frequency doubling is 0. At this time, the effective length of LBO crystal can theoretically reach infinity, which can compensate for its small non-linear coefficient. Because its damage threshold is very large, it means that high-power fundamental wave pumping can be realized. Therefore, the conversion efficiency of fundamental frequency light will be greatly improved by using the non-critical phase matching of LBO crystal for the extra-cavity frequency doubling of pulsed laser. The beam quality and stability of frequency light will be greatly improved.

FEATURES

- High damage threshold
- Wide transparency range
- Wide acceptance angle
- Large range of tunable wavelengths
- Small walk-off angle

APPLICATIONS

- SHG(second-harmonic generation), THG(third-harmonic generation)
- OPO(optical parametric oscillator)
- OPA(optical parametric amplification)
- NCPA SHG, THG
- Electro-optic modulator



PARAMETERS

PHYSICAL AND CHEMICAL PROPERTIES

Property	Value
Chemical formula	LiB_3O_5
Crystal structure	Orthorhombic, Space group Pna21 Point group mm2
Lattice Parameter	$a=8.4473\text{\AA}$, $b=7.3788\text{\AA}$ $c=5.1395\text{\AA}$, $Z=2$
Mass density	2.47 g/cm ³
Moh hardness	6
Melting point	About 834°C
Thermal conductivity	2.7W/mK(∥X) 3.1W/mK(∥Y) 4.5W/mK(∥Z)
Birefringence	Negative biaxial crystal: $2V_z = 109.2^\circ$ at $\lambda = 0.5321\mu\text{m}$

NONLINEAR OPTICAL PROPERTIES

Property	Value
SHG phase matchable range	551 ~ 2600nm (Type I); 790-2150nm (Type II)
NLO coefficients	$d_{\text{eff}}(\text{I})=d_{32}\cos\Phi$ (Type I in XY plane) $d_{\text{eff}}(\text{I})=d_{31}\cos^2\theta+d_{32}\sin^2\theta$ (Type I in XZ plane) $d_{\text{eff}}(\text{II})=d_{31}\cos\theta$ (Type II in YZ plane) $d_{\text{eff}}(\text{II})=d_{31}\cos^2\theta+d_{32}\sin^2\theta$ (Type II in XZ plane)
Non-Vanished NLO susceptibilities	$d_{31}=1.05 \pm 0.09$ pm/V $d_{32}=-0.98 \pm 0.09$ pm/V $d_{33}=0.05 \pm 0.006$ pm/V
Therm-optic coefficients (°C, λ in μm)	$dn_x/dT=-9.3\times 10^{-6}$ $dn_y/dT=-13.9\times 10^{-6}$ $dn_z/dT=(-6.3-2.1\lambda)\times 10^{-6}$
Angle Acceptance	6
Melting point	About 834°C
Thermal conductivity	3.5W/m/K
Birefringence	Negative biaxial crystal: $2V_z = 109.2^\circ$ at $\lambda = 0.5321\mu\text{m}$

EXPERIMENTAL VALUES OF PHASE-MATCHING ANGLE (T = 293K)

Interacting wavelengths(nm)	Φ_{exp} [deg]	θ_{exp} [deg]
XY plane, $\theta = 90^\circ$		
SHG, o+o → e		
1908 → 954	23.8	
1500 → 750	7	
1064 → 532	11.4	
880 → 440	24.53	
746 → 373	37.5	
630 → 315	55.6	
554 → 277	90	
XY plane, $\theta = 90^\circ$		
SHG, e+o → e		
1340 → 670		4.2
1300 → 650		5.4
XZ plane, $\Phi=0^\circ, \theta > V_z$		
SHG, e+e → o		
1340 → 670		86.3
1300 → 650		86.1
1240 → 620		86

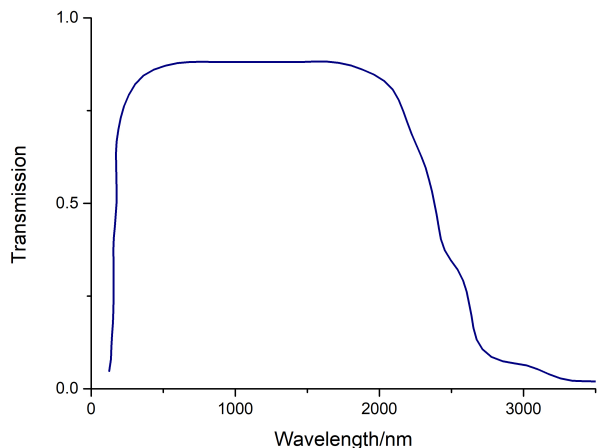
EXPERIMENTAL VALUES OF PHASE-MATCHING ANGLE (T = 293K)

Interacting wavelengths(nm)	T [°C]
along X axis	
SHG, type I	
1547 → 773	117
1460 → 730	50
1206 → 603	24
1150 → 575	61.1
1025 → 512	190.3
SFG, type I	
1908+1064 → 683	81
1444+1080 → 618	23
1135+1064 → 549	112
1547+774 → 516	141
DFG, type I	
532-800 → 1588	135

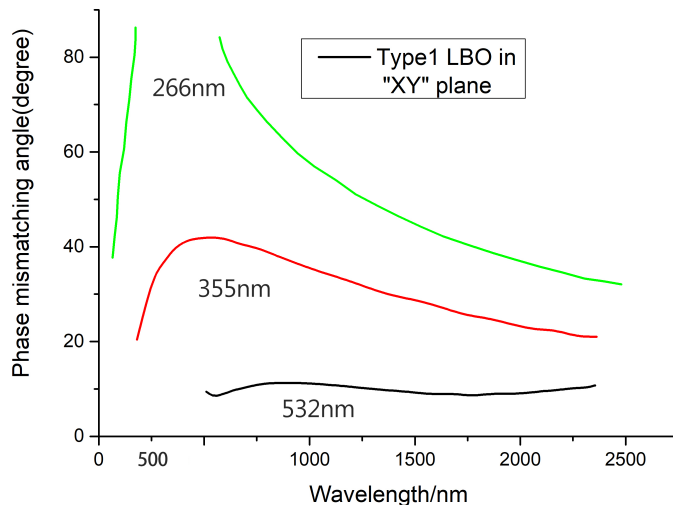


MgO:LiNbO₃ MgO doped LiNbO₃

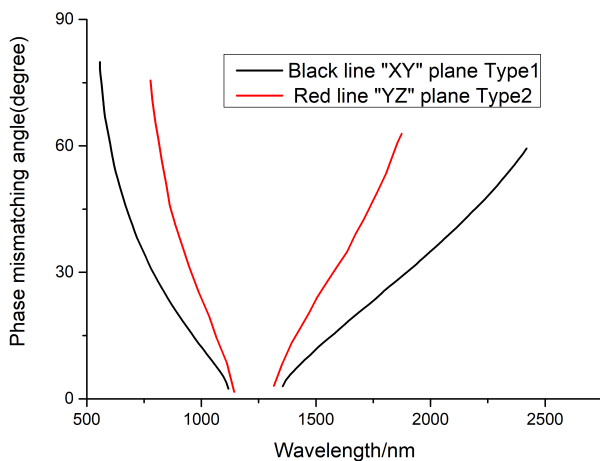
SPECTRA



LBO Nonlinear Crystal Transmission Spectrum



OPO tuning curves of LBO (Type1 (ooe) in 'XY' plane) with different pump light, namely 530 nm, 355 nm and 266 nm



SHG tuning curves of LBO Nonlinear Crystal

