LBO

DESCRIPTION

LiB_3O_5 (Lithium Triborate) crystal is one of the most excellent nonlinear optical crystals found so far that can be used for non-critical phase matching laser frequency doubling, it has good nonlinear optical properties and stable physical and chemical properties, which is especially important because its dispersion amount is sensitive to temperature changes, and it can achieve non-critical phase matching during the frequency doubling process, due to its large damage threshold, which means that it can achieve High-power fundamental pumping and also longer optical crystals can be used, which are undoubtedly useful for obtaining high-power frequency doubling lasers.

At 1.064 μm light, the effective SHG coefficient of the LBO crystal is three times higher than that of the KDP. the optical damage threshold of the LBO is the highest among the commonly used inorganic nonlinear optical crystals. Therefore, it is one of the best choices for high power second harmonic generators and other nonlinear optical applications.

FEATURES

- High optical uniformity
- Wide transparent area
- Wide tunable wavelength range
- low sensitivity to moisture
- Wide receiving angle, small discrete angle
- Spectral Noncritical Phase Matching (NCPM) close to 1300nm
- Class I, II Non-Critical Phase Matching (NCPM) Wide Band Range
- High damage threshold (1053nm laser with pulse width of 1.3ns can reach 10GW/cm^2)
- High frequency doubling conversion efficiency (equivalent to 3 times that of KDP crystal)

APPLICATIONS

- OPO (Optical Parametric Oscillator)
- OPA (Optical Parametric Amplification)
- NCPA SHG,THG Electro-Optic Modulator
- SHG (Second Harmonic Generation), THG (Third Harmonic Generation)

LBO

PHYSICOCHEMICAL PROPERTIES

Attributes	Numerical value
chemical formula	LiB_3O_5
Crystal structure	Rhombus, space group Pna21, point group mm^2
Lattice parameters	a=8.4473Å ,b=7.3788Å, c=5.1395Å, Z=2
mass density	2.47 g/cm^3
Moh's hardness	6
melting point	About 834°C
Thermal Conductivity	3.5W/m/K
birefringence	Negative biaxial crystal: 2Vz =109.2° when λ=0.5321μm

NONLINEAR OPTICAL PROPERTIES

Attributes	Numerical value
SHG phase matching range	551 ~ 2600nm (Type I)
	790-2150nm (Type II)
NLO coefficient	$deff(I) = d_{32}cosΦ$ (type I in XY plane)
	$deff(I) = d_{31}cos2θ+d_{32}sin2θ$ (type I in XZ plane)
	$deff(II) = d_{31}cosθ$ (type II in YZ plane)
	$deff(II) = d_{31}cos2θ+d_{32}sin2θ$ (type II in XZ plane)
NLO sensitivity has not disappeared	d_{31}=1.05 ± 0.09 pm/V
	d_{32}=-0.98 ± 0.09 pm/V
	d_{33}= 0.05 ± 0.006 pm/V
Thermal Optical Coefficient (°C, λinμm)	dn_x/dT=-9.3×10^{-6}
	dn_y/dT=-13.6×10^{-6}
	dn_z/dT=$(-6.3-2.1λ) \times 10^{-6}$
angle acceptance	6.54mrad cm (Φ, I type, 1064 SHG)
	15.27mrad cm (q, type II, 1064 SHG)

NONLINEAR OPTICAL PROPERTIES

Attributes	Numerical value
Transparent range	169 – 2600 nm
absorption coefficient	<0.1%/cm @1064nm
	<0.3%/cm @ 532nm
Refractive index at 1.0642 mm	n_x = 1.5656, n_y = 1.5905, n_z=1.6055
Refractive index at 0.5321 mm	n_x = 1.5785, n_y = 1.6065, n_z=1.6212
Refractive index at 0.2660 mm	n_x = 1.5973, n_y = 1.6286, n_z=1.6444
Sellmeier equation (λin μm)	$n_x^2=2.454140+0.011249/(λ^2-0.011350)-0.014591λ^2-6.60\times10^{-5}λ^4$
	$n_y^2=2.539070+0.012711/(λ^2-0.012523)-0.018540λ^2+2.0\times10^{-4}λ^4$
	$n_z^2=2.586179+0.013099/(λ^2-0.011893)-0.017968λ^2-2.26\times10^{-4}λ^4$

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PHASE MATCHING ANGLE EXPERIMENTAL VALUE (T=293K)

Interaction wavelength [µm]	Φ$_{exp}$ [deg]	θ$_{exp}$ [deg]
XY plane θ= 90°		
SHG, o+o ⇒ e		
1.908⇒0.954	23.8	
1.5⇒0.75	7	
1.0642⇒0.5321	11.4	
0.88⇒0.44	24.53	
0.746⇒0.373	37.5	
0.63⇒0.315	55.6	
0.554⇒0.277	90	
XZ plane, Φ=0◦, θ<Vz		
SHG, e+o ⇒ e		
1.3414⇒0.6707		4.2
1.3⇒0.65		5.4
XZ plane, Φ=0◦, θ>Vz		
SHG, e+e ⇒ o		
1.3414⇒0.6707		86.3
1.3⇒0.65		86.1
1.24⇒0.62		86

EXPERIMENTAL VALUES OF NON-CRITICAL PHASE MATCHING (NCPM) TEMPERATURE

Interaction wavelength [µm]	T[℃]
along the X axis	
SHG, typeI	
1.547⇒0.7735	117
1.46⇒0.73	50
1.46⇒0.73	24
1.15⇒0.575	61.1
1.025⇒0.5125	190.3
SFG, typeI	
1.908+1.0642⇒0.6832	81
1.444+1.08⇒0.6179	23
1.135+1.0642⇒0.5491	112
1.547+0.7735⇒0.5157	141
DFG, typeI	
0.532-0.8⇒1.588	135

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