



Nonlinear Crystals

NONLINEAR CRYSTALS

LASER CRYSTALS

TERAHERTZ CRYSTALS

RAMAN CRYSTALS

POSITIONERS & HOLDERS

CRYSTAL OVENS

LBO

LITHIUM TRIBORATE



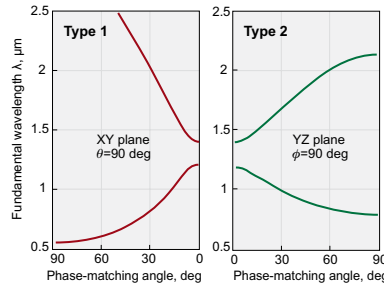
- wide transparency region
- broad Type 1 and Type 2 non-critical phase-matching (NCPM) range
- small walk-off angle
- high damage threshold
- wide acceptance angle
- high optical homogeneity

LBO is well suited for various nonlinear optical applications:

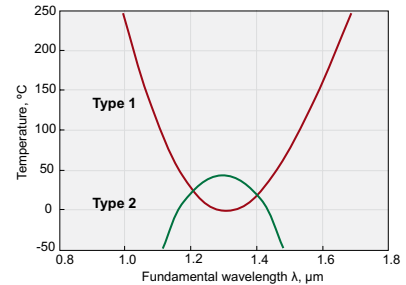
- frequency doubling and tripling of high peak power pulsed Nd doped, Ti:Sapphire and Dye lasers
- optical parametric oscillators (OPO) of both Type 1 and Type 2 phase-matching
- non-critical phase-matching for frequency conversion of CW and quasi-CW radiation.

EK SMA OPTICS OFFERS

- crystals length up to 50 mm and aperture up to 40×40 mm
- thin crystals down to 10 μm thickness
- AR, BBAR, P-coating
- different mounting and repolishing services
- accurate quality control
- attractive prices and fast delivery
- one month customer's satisfaction term.



SHG tuning curves of LBO



NCPM SHG temperature dependence of LBO

PHYSICAL AND OPTICAL PROPERTIES

Chemical formula	LiB ₃ O ₅		
Crystal structure	orthorhombic, mm2		
Optical symmetry	Negative biaxial		
Space group	Pna2 ₁		
Density	2.47 g/cm ³		
Mohs hardness	6		
Optical homogeneity	Δn = 10 ⁻⁶ cm ⁻¹		
Transparency region at "0" transmittance level	155 – 3200 nm		
Linear absorption coefficient at 1064 nm	< 0.01 % cm ⁻¹		
Refractive indices:	n _x	n _y	n _z
at 1064 nm	1.5656	1.5905	1.6055
at 532 nm	1.5785	1.6065	1.6212
at 355 nm	1.5971	1.6275	1.6430
Sellmeier equations (λ, μm)	$n_x^2 = 2.4542 + 0.0113 / (\lambda^2 - 0.0114) - 0.0139 \lambda^2$ $n_y^2 = 2.5390 + 0.0128 / (\lambda^2 - 0.0119) - 0.0185 \lambda^2$ $n_z^2 = 2.5865 + 0.0131 / (\lambda^2 - 0.0122) - 0.0186 \lambda^2$		
Phase matching range Type 1 SHG	554 – 2600 nm		
Phase matching range Type 2 SHG	790 – 2150 nm		

NCPM SHG temperature dependence:	
Type 1 range 950 – 1300 nm	$T1 = -1893.3\lambda^4 + 8886.6\lambda^3 - 13019.8\lambda^2 + 5401.5\lambda + 863.9$
Type 1 range 1300 – 1800 nm	$T2 = 878.1\lambda^4 - 6954.5\lambda^3 + 20734.2\lambda^2 - 26378\lambda + 12020$
Type 2 range 1100 – 1500 nm	$T3 = -21630.6\lambda^4 + 112251\lambda^3 - 220460\lambda^2 + 194153\lambda - 64614.5$
NCPM SHG at 1064 nm Type 1 temperature	149 °C
NCPM SHG at 1319 nm Type 2 temperature	43 °C
Walk-off angle	4 mrad (Type 1 SHG 1064 nm)
Thermal acceptance	6.4 K×cm (Type 1 SHG 1064 nm)
Angular acceptance	6.5 mrad×cm (Type 1 SHG 1064 nm)
	248 mrad×cm (Type 1 NCPM SHG 1064 nm)
Nonlinearity coefficients:	$d_{31} = (1.09 \pm 0.09)$ pm/V
	$d_{32} = (1.17 \pm 0.14)$ pm/V
Effective nonlinearity:	
XY plane	$d_{\text{ooe}} = d_{32} \cos\phi$
YZ plane	$d_{\text{eoo}} = d_{\text{eoo}} = d_{31} \cos\theta$

Please contact EKSMA OPTICS for special OEM and large volume pricing.

 Wide selection of non-standard size and cut angle LBO crystals is available at www.eksmaoptics.com



STANDARD SPECIFICATIONS

Flatness	$\lambda/8$ at 633 nm
Parallelism	< 20 arcsec
Surface quality	10-5 scratch & dig (MIL-PRF-13830B)
Perpendicularity	< 5 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Clear aperture	90% of full aperture

Please contact EKSMA OPTICS for further information or nonstandard specifications.

STANDARD CRYSTALS LIST

Code	Size, mm	θ , deg	ϕ , deg	Coating	Application	Price, EUR
LBO-401	3x3x10	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	245
LBO-402	3x3x15	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	325
LBO-403	5x5x15	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	765
LBO-404	3x3x15	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	325
LBO-405	3x3x20	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	405
LBO-406	3x3x10	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	245
LBO-407	3x3x15	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	325
LBO-408	5x5x15	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	765

RELATED PRODUCTS

LBO crystals for SHG of Yb:KGW/KYW laser frequency conversion. See page 5.32

Crystal Oven TC1

See page 2.27



149 °C temperature is required to achieve Non-Critical Phase Matching (NCPM) in LBO at type 1 SHG of 1064 nm application. **TC1 oven** is specially designed for this purpose (see technical specifications, p. 2.27).

Nonlinear Crystal Oven CH7

See page 2.30



CH7 oven is designed to keep the crystal at the elevated temperature (40–60 °C) for thermostabilisation of nonlinear crystal. The elevation of working temperature also extends hygroscopic crystals lifetime. LBO crystal is slightly hygroscopic and polished faces could become foggy after some time of exposition of crystal at ambient environment.

HOUSING ACCESSORIES

Ring Holders for Nonlinear Crystals

See page 2.24



Positioning Mount 840-0056

See page 2.25



Kinematic Positioning Mount 840-0193

See page 2.25

