

# Lithium Triborate – LBO



LBO is a nonlinear optical crystal with combination of number of unique features:

- 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.

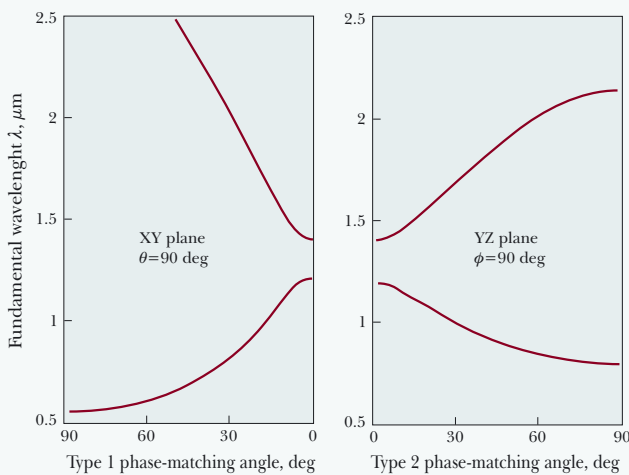
LBO is perfectly suitable for various nonlinear optical applications:

- 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 conversion of CW and quasi-CW radiation.

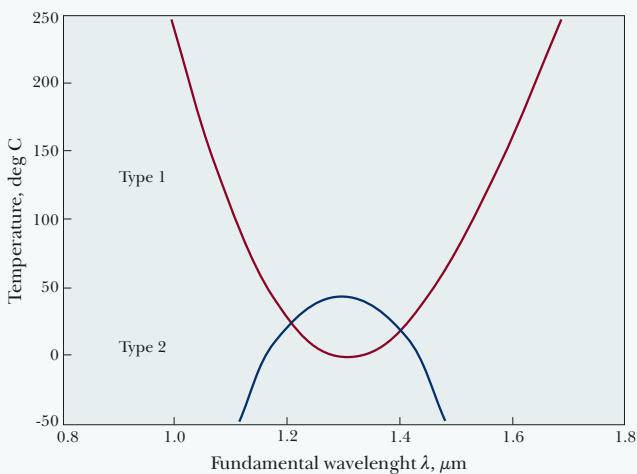
## EKSPLA offers:

- crystals length up to 50 mm and aperture up to 30 × 30 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.

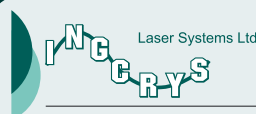
*Please contact EKSPLA for further information or nonstandard specifications.*



SHG tuning curves of LBO



NCPM SHG temperature dependence of LBO



**EKSPLA**  
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**PHYSICAL AND OPTICAL PROPERTIES OF LBO**

Chemical formula	$\text{LiB}_3\text{O}_5$
Crystal structure	orthorhombic, mm2
Optical symmetry	Negative biaxial
Space group	$\text{Pna}2_1$
Density	2.47 g/cm <sup>3</sup>
Mohs hardness	6
Optical homogeneity	$\delta n = 10^{-6} \text{ cm}^{-1}$
Transparency region at "0" transmittance level	155 – 3200 nm
Linear absorption coefficient at 1064 nm	< 0.01 % cm <sup>-1</sup>
Refractive indices:	
at 1064 nm	$n_x = 1.5656$ $n_y = 1.5905$ $n_z = 1.6055$
at 532 nm	1.5785      1.6065      1.6212
at 355 nm	1.5971      1.6275      1.6430
Sellmeier equations ( $\lambda$ :[ $\mu\text{m}$ ]):	
	$n_x^2 = 2.4542 + 0.0113/(\lambda^2 - 0.0114) - 0.0139\lambda^2$
	$n_y^2 = 2.5390 + 0.0128/(\lambda^2 - 0.0119) - 0.0185\lambda^2$
	$n_z^2 = 2.5865 + 0.0131/(\lambda^2 - 0.0122) - 0.0186\lambda^2$
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:	$d_{31} = (1.09 \pm 0.09) \text{ pm/V}$ $d_{32} = (1.17 \pm 0.14) \text{ pm/V}$
Effective nonlinearity:	
XY plane	$d_{\text{ooe}} = d_{32} \cos\varphi$
YZ plane	$d_{\text{eoo}} = d_{\text{eoo}} = d_{31} \cos\theta$
Damage threshold for TEM <sub>00</sub> 1064 nm	> 10 GW/cm <sup>2</sup> at 10 ns

**STANDARD SPECIFICATIONS OF LBO CRYSTALS**

Flatness	$\lambda/6$ at 633 nm
Parallelism	< 10 arc sec
Perpendicularity	< 5 arc min
Angle tolerance	< 30 arc min
Aperture tolerance	± 0.1 mm
Surface quality	10/5 scratch/dig as per MIL-O-13830A
Clear aperture	90% of full aperture