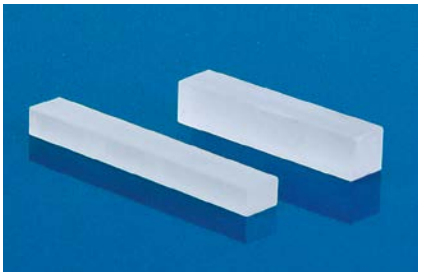
Nonlinear Crystals

LBO – LITHIUM TRIBORATE



LBO is well suited for various nonlinear optical applications:

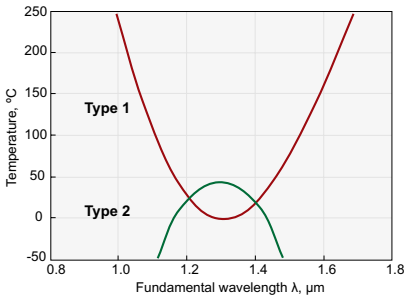
- frequency doubling and tripling of high peak power pulsed Nd doped, Ti:Sapphire and Dye lasers
- optical parametric oscillators (OPO) of both Type 1 and Type 2 phase-matching
- non-critical phase-matching for frequency conversion of CW and quasi-CW radiation.

STANDARD SPECIFICATIONS

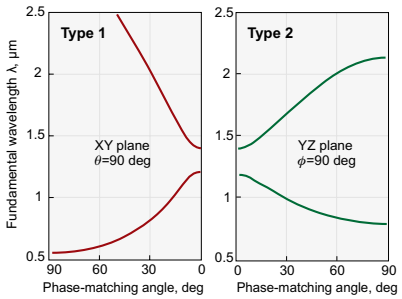
Flatness	λ/8 at 633 nm
Parallelism	< 20 arcsec
Surface quality	10 – 5 scratch & dig (MIL-PRF-13830B)
Perpendicularity	< 5 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Clear aperture	90% of full aperture

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



NCPM SHG temperature dependance of LBO



SHG tuning curves of LBO

WE OFFER:

- Crystals length up to 90 mm and aperture up to 60×60 mm
- AR, BBAR, P-coatings
- Different mounting and repolishing services

STANDARD CRYSTALS LIST

Size, mm	θ, deg	φ, deg	Coating	Application	Catalogue number	Price, EUR
3x3x10	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-401	245
3x3x15	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-402	325
4x4x10	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-301	510
4x4x15	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-302	630
4x4x20	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-303	745
5x5x10	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-501	655
5x5x15	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-503	765
5x5x20	90	11.6	AR/AR @ 1064+532 nm	SHG @ 1064 nm	LBO-502	940
3x3x15	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-404	325
3x3x20	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-405	405
3x3x30	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-409	710
3x3x50	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-410	1300
4x4x10	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-304	510
4x4x15	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-305	630
4x4x20	90	0	AR/AR @ 1064+532 nm	NCPM SHG @ 1064 nm, T = 149 °C	LBO-306	745
3x3x10	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-406	245
3x3x15	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-407	325
4x4x10	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-307	510
4x4x15	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-308	630
5x5x10	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-507	655
5x5x15	42.2	90	AR/AR @ 1064+532/355 nm	THG @ 1064 nm	LBO-508	765

PHYSICAL AND OPTICAL PROPERTIES

Chemical formula	LiB_3O_5		
Crystal structure	orthorhombic, mm2		
Optical symmetry	Negative biaxial		
Space group	$Pna2_1$		
Density	2.47 g/cm^3		
Mohs hardness	6		
Optical homogeneity	$\partial n = 10^{-6}$ 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)	$n_x^2 = 2.4542 + 0.01125 / (\lambda^2 - 0.01135) - 0.01388\ \lambda^2$ $n_y^2 = 2.5390 + 0.01277 / (\lambda^2 - 0.01189) - 0.01849\ \lambda^2 + 4.3025 \times 10^{-5}\lambda^4 - 2.9131 \times 10^{-5}\lambda^6$ $n_z^2 = 2.5865 + 0.0131 / (\lambda^2 - 0.01223) - 0.01862\ \lambda^2 + 4.5778 \times 10^{-5}\lambda^4 - 3.2526 \times 10^{-5}\lambda^6$		
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	7 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	$d_{31} = -(0.98 \pm 0.09)$ pm/V; $d_{32} = (1.05 \pm 0.09)$ pm/V; $d_{33} = (0.05 \pm 0.006)$ pm/V		
Effective nonlinearity:			
XY plane	$d_{ooe} = d_{32}\ \cos\varphi$		
YZ plane	$d_{oeo} = d_{eoo} = d_{31}\cos\theta$		
Expansion coefficients	$\alpha_x = 10.8 \times 10^{-5}$ K^{-1}; $\alpha_y = -8.8 \times 10^{-5}$ K^{-1}; $\alpha_z = 3.4 \times 10^{-5}$ K^{-1}		
Laser induced damage threshold (LIDT)	>5 J/cm^2 (>500 MW/cm^2), 1064 nm, 10 ns, 10 Hz		

Please contact EKSMA OPTICS for further information or nonstandard specifications.

RELATED PRODUCTS

LBO crystals for SHG of Yb:KGW/KYW laser frequency conversion. *See page 4.42*

Crystal Oven TC2
See page 2.28

149 °C temperature is required to achieve Non-Critical Phase Matching (NCPM) in LBO at type 1 SHG of 1064 nm application. **TC2 oven** is specially designed for this purpose (see technical specifications, p. 2.28).

Heatpoint Crystal Oven
See page 2.29

Heatpoint is a compact round oven designed for heating (30 – 80 °C) of humidity sensitive nonlinear crystals. It is used to prevent moisture condensation on crystal faces or for thermostabilization of the crystals.