GAMDAN OPTICS

Lithium Tri-Borate (LiB_3O_5)

About GAMDAN

GAMDAN is a Silicon Valley-based high-temperature nonlinear optical crystal growth and fabrication operation. Since 2006, we have focused on the growth of high quality BBO and LBO crystals for visible and UV applications. We also fabricated KTP crystals for OPO and SHG.

We also offer contract fabrication for other materials such as $LiNO_3$, $Nd:YVO_4$. We offer the high quality, quick-turn around rework with rush delivery within days.

Lithium Tri-borate (LBO) is one of the most useful nonlinear optical material not just for its relatively large conversion coefficient - 3x that of KDP, but also for its excellent physical properties.

GAMDAN LBO offers

- **Exceptionally low absorption <1.5ppm (0.0000015%) in the IR as tested by Photo-thermal Common-Path Interferometer. (Test results available upon request)**
- **Excellent Homogeneity of λ/10**
- **Exceptional surface finish for optimal high-power performance, S/D of 0/0 for up to 5x5mm cross section**
- **Size up to 30x30mm cross section, or 60mm in length**
- **100% satisfaction guaranteed or free replacement**

In addition to LBO's intrinsic advantages

- **Broad transparency range from 160nm to 2600nm**
- **High damage threshold**
- **Wide acceptance angle and small walk-off**
- **Type I and type II NCPM**
- **Spectral NCPM near 1300nm**

Made in the USA

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Lithium Tri-Borate

GAMDAN LBO Specifications

Thin crystals: (5-10) x (5-10) x (0.05-3) mm^3
Regular sizes: 2 x 2 mm^2 to 30 x 30 mm^2 in cross section, up to 60 mm in length
Absorption < 10ppm (0.00001%) @1064, homogeneity λ/10
S/D of 0/0 for cross section up to 5 x 5 mm
Different cuts, sizes and AR coatings are available upon request.

Crystal Structural and Physical Properties

Chemical Formula	LiB_3O_5
Crystal Structure	Orthorhombic, mm2
Cell Parameters	a = 8.4473, b = 7.3788Å, c = 5.1395Å, Z = 2
Melting point	834°C
Optical homogeneity	$\delta n \sim 10^{-6}/cm$
Mohs hardness	6
Density	2.47 g/cm^3
Absorption coefficient	< 0.1%/cm (at 1064nm and 532nm)
Specific heat	1.91J/cm^3xK
Hygroscopic susceptibility	low
Thermal expansion coefficients	a, 4 x 10^{-6}/K; c, 36 x 10^{-6}/K
Thermal conductivity	⊥ c, 1.2 W/m/K; //c, 1.6 W/m/K

Linear Optical Properties

Transparency range	160-2600nm
Refractive indices:	
at 1064nm	n_x = 1.5656, n_y = 1.5905, n_z = 1.6055
at 532nm	n_e = 1.5785, n_o = 1.6065, n_z = 1.6212
at 355nm	n_e = 1.5971, n_o = 1.6275, n_z = 1.6430
Therm-optic coefficients	dn_o/dT = -9.3 x 10^{-6}/°C dn_e/dT = -16.6 x 10^{-6}/°C
Sellmeier Equations (λ in mm)	
$n_o^2(\lambda) = 2.7359 - 0.01354\lambda^2 + 0.01878/(\lambda^2 - 0.01822)$	
$ne^2(\lambda) = 2.3753 - 0.01516\lambda^2 + 0.01224/(\lambda^2 - 0.01667)$	

Nonlinear Optical Properties

Phase-matchable output wavelength	554 - 2660nm (type I), 790 – 2150nm (type II)
NLO coefficients	d_{33} = 0.06; d_{32} = 1.2; d_{22} = 1.1
Walk-off Angles(@ 1064nm)	0.4° (Type I SHG), 0.3° (Type II SHG)
Acceptance Angles(@1064nm) for SHG Type I	9.6(mrad-cm) CPM at 25°C 248(mrad-cm) NCPM at 150°C
Electro-optic coefficients	γ_{11} = 2.7 pm/V, γ_{22}, $\gamma_{31} < 0.1\gamma_{11}$
Conversion Efficiency	>90% (1064 -> 532nm) Type I SHG
Damage threshold	
at 1064nm	45 GW/cm^2 (1 ns); 10 GW/cm^2 (1.3 ns)
at 532nm	26 GW/cm^2 (1 ns); 7 GW/cm^2 (250 ps)
at 355nm	22 GW/cm^2