GAMDAN OPTICS

Beta-Barium Borate (β-BaB_2O_4)

Beta-Barium Borate (BBO) is an excellent non-linear crystal for frequency-doubling (SHG) of Visible and Near IR laser light, OPO/OPG/OPA pumped by ultrafast pulses of wavelengths in the Near IR to UV, and sum-frequency mixing (SFM) into the Visible to the deep UV. BBO is the only practical crystal for use below 500nm in SHG and SFM.

BBO crystal has broad tunability, high damage threshold, and high efficiency. BBO's small acceptance angle requires a very good beam quality and its large walk-off results in output beams that are very elliptical or slit-like. Type I is usually much more efficient than type II operation. BBO cannot be used for NCPM (temperature tuned) application. BBO is very good for tunable laser sources, such as ultrafast Ti:Sapphire or dye lasers. It is also widely used for SHG, 3HG, 4HG, and autocorrelation of femtosecond and picosecond Ti:Sapphire lasers; SHG, 3HG, 4HG, 5HG of YAG lasers at 1064nm and 1320nm to yield output of 212-660nm; SHG of tunable dye or solid-state laser sources from 410-750nm to yield output of 205-375nm, SFM of dye laser and YAG harmonics to yield output of 189-400nm; DFM (difference-frequency mixing) from the Visible to the IR range up to over 3000nm; OPO pumped with SHG or 3HG of YAG or Ti:Sapphire with an output range of 400-3000; intracavity SHG of Argon ion lasers (488nm, 514nm) or Copper vapor lasers (510nm, 578nm).

About GAMDAN

GAMDAN started in 2006, gathering more than 20 years of crystal growing and fabrication expertise in order to produce nonlinear optical crystals of the highest quality. Currently we are focus in the growth and fabrication of LBO and BBO for visible and UV applications. We also fabricated KTP for OPO and SHG.

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

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Beta-Barium Borate

Crystal Structural and Physical Properties

Crystal Structure	Trigonal, space group R_{3c}
Cell Parameters	a = b = 12.532Å, c = 12.717Å, Z = 6
Melting point	1095± 5°C
Transition temperature	925± 5°C
Optical homogeneity	δ n ~ 10^{-6}/cm
Mohs hardness	4
Density	3.85 g/cm^3
Absorption coefficient	< 0.1%/cm (at 1064nm)
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	$\perp$ c, 1.2 W/m/K; //c, 1.6 W/m/K

Linear Optical Properties

Transparency range	189-3500nm
Refractive indices:	n_e = 1.5425, n_o = 1.6551
at 1064nm	n_e = 1.5555, n_o = 1.6749
at 532nm	n_e = 1.6146, n_o = 1.7571
at 266nm	
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	189 - 1750nm
NLO coefficients	d_{11} = 5.8 x d_{36} (KDP)
	d_{31} = 0.05 x d_{11}
	d_{22} < 0.05 x d_{11}
Electro-optic coefficients	γ_{11} = 2.7 pm/V, γ_{22}, γ_{31} < 0.1γ_{11}
Half-wave voltage	48 KV (at 1064nm)
Damage threshold	
at 1064nm	5 GW/cm^2 (10 ns); 10 GW/cm^2 (1.3 ns)
at 532nm	1 GW/cm^2 (10 ns); 7 GW/cm^2 (250 ps)

BBO Typical Specifications

Thin crystals: 5 x 5 x (0.05-3) mm^3, 10x10x(0.1-3) mm^3

Regular sizes: 4 x 4 mm^2 to 20 x 20 mm^2 in diameter, 3 - 25 mm in length, for Z-cut Q-switch material we offer up to 6 x 6 x 25mm

Different cuts, sizes and AR coatings are available upon request.
BBO is hygroscopic. In application, protective coating or AR coating or crystal housing is usually recommended.