

Chemical Formula:	<b>b-BaB<sub>2</sub>O<sub>4</sub></b>
Crystal Symmetry:	<b>Trigonal</b>
Optical Symmetry:	<b>Uniaxial negative</b>
Class:	<b>3m</b>

## BBO Single Crystals

Beta-barium Borate (BBO) is a nonlinear optical crystal used in a wide variety of phasematching applications. Its properties also make it an ideal candidate material for transverse field Pockels cells. Inrad Optics grows BBO crystals using a proprietary top seeded flux growth method. All crystal growth, orientation, fabrication, polishing, coating and testing of BBO crystal components takes place in our New Jersey facility, assuring you of complete traceability and satisfaction with every crystal we produce. Inrad Optics can fabricate and polish BBO crystals to almost any size and orientation.



### Features

- Large effective nonlinear coefficients
- Broad phasematching range from 410 to 2100 nm
- Wide optical transmission range from 200 to 2100 nm
- High laser damage threshold
- Low thermo-optic coefficient

### Advantages

- Second harmonic generation to generate wavelengths as short as 204.8 nm
- Shorter wavelengths can be generated by sum frequency mixing
- Fifth harmonic generation of Nd:YAG by mixing the fundamental and the fourth harmonic

## Ordering Information

- **Sizes.** Crystal lengths range from 50 $\mu$ m for extremely short pulse widths to about 20 mm for nanosecond OPO/OPA use. Aperture sizes can be as large as 20 x 20 mm. The optimum length is largely determined by the angular acceptance of the crystal for phasematching.
- **Orientation.** Specify Type I or Type II and the phase match angle ( $\theta$ ). Crystals are oriented in a double crystal x-ray spectrometer and are typically accurate to within 1 arcminute.
- **Finishing.** Transmitted wavefront distortion is typically  $\lambda/10$ . Crystals can be wedged, typically 30 arcseconds in the less critical tuning direction or made parallel to <5 seconds. Surface finish is 10/5 or better. Alternatively, crystals can be made with a Brewster cut when used with high laser damage applications requiring low insertion losses.
- **Coatings.** BBO crystals are available with a thin, transparent protective dielectric coating that first and foremost protects the polished surfaces of this water-soluble crystal from fogging due to ambient moisture. The protective coating also:
  - Reduces reflection from the polished surface, improving transmission for all wavelengths.
  - Allows for fewer beam components, maximizing nonlinear conversion efficiencies.
  - Reduces temporal distortions when ultrafast light pulses are used.

BBO Standard Orientations				
Designation	Angle $\theta$	Operation	Input	Output
"0"	68.5°	SHG	418-464 nm	209-232 nm
		THG	(600-665 nm) + (300-331 nm)	200-220 nm
"1"	53.2°	SHG	454-560 nm	209-232 nm
		THG	(651-800 nm) + (325-400 nm)	217-266 nm
"2"	37.4°	SHG	542-820 nm	271-410 nm
		THG	(774-1165 nm) + (387-582 nm)	258-388 nm
"A"	78°	SHG	410-433 nm	205-216 nm
		THG	(594-620 nm) + (297-310 nm)	198-206 nm
"B"	55°	SHG	448-543 nm	224-271 nm
		THG	(642-775 nm) + (321-358 nm)	214-258 nm
"C"	65°	SHG	423-480 nm	211-240 nm
		THG	(608-687 nm) + (304-343 nm)	203-229 nm
"TSS"	28.7°	SHG	636-1000 nm	318-500 nm
		THG	(906-2100 nm) + (453-1050 nm)	302-700 nm
"TST"	44°	SHG	496-675 nm	248-337 nm
		THG	(710-960 nm) + (355-480 nm)	237-320 nm
"OPO1"	36.6°	SHG	549-844 nm	275-422 nm
		THG	(784-1200 nm) + (392-600 nm)	262-400 nm
		SFM	1064 nm + (510-567 nm)	345-370 nm
"OPO2"	57.5°	SHG	440-525 nm	220-262 nm
		THG	(632-750 nm) + (316-375 nm)	211-250 nm
"M1"	50.2°	SFM	1064 nm + (243-340 nm)	198-257 nm
"DGN"	31°	SFM	1064 nm + (380-980 nm)	280-510 nm
"IDLR"	20°	SHG	1380-1460 nm	690-730 nm
"OPO3"	30°	OPO	355 nm	410-2000 nm
"SHG"	22.8°	SHG	1064 nm	532 nm
"THG"	31.3°	THG	1064 nm + 532 nm	355 nm
"4HG"	47.6°	4HG	532 nm	266 nm
—	22°	SHG	1550 nm	775 nm

BBO crystals are normally supplied with a single-layer MgF2 protective coating

### Orientation Types

