

BBO Crystal

BBO (Beta-Ba₂BO₄, Beta-Barium Borate) crystal is one of the most widely used nonlinear crystal. BBO crystal combines the features of,

- *Wide transparency wavelength range (189-3500nm)*
- *Broad phase-matchable SHG wavelength range (409.6-3500nm)*
- *Large effective nonlinear coefficient*
- *High damage threshold*
- *High optical homogeneity*
- *Good mechanical and physical properties.*

Properties of BBO Crystal

Crystal Structure: Trigonal, space group R_{3c}

Lattice Parameter: a=b=12.532Å c=12.717Å Z=6

Melting point: ~1095 deg. C

Mohs Hardness: 4

Density: 3.85g/cm³

Thermal Conductivity: 1.2W/m/K(⊥c): 1.6W/m/K(//c)

Thermal Expansion: a₁₁=4x10⁻⁶/K; a₃₃=36x10⁻⁶/K

BBO Transparency Range: 190-3500nm

BBO SHG Phase Matchable Range:

409.6-3500nm(Type I) 525-3500nm(Type II)

Thermo-Optic Coefficients: dno/dx-16.6x10⁻⁶ dne/dx-9.3x10⁻⁶

Absorption Coefficients: 0.1%/cm@1064nm 1%/cm@532nm

Angle Acceptance: 0.8mrad-cm(Type I, SHG@1064nm)

1.27mrad-cm(Type II, SHG@1064nm)

Temperature Acceptance: 55degC-cm

Spectral Acceptance: 1.1nm-cm

Walk-off Angle: 2.7°(Type I SHG@1064nm) 3.2°(Type II SHG@1064nm)

BBO Crystal NLO Coefficients:

$$d_{\text{eff}}(\text{I}) = d_{31} \sin(\theta) + (d_{11} \cos(\varphi) - d_{22} \sin(3\varphi)) \cos(\theta)$$

$$d_{\text{eff}}(\text{II}) = (d_{11} \sin(3\varphi) + d_{22} \cos(3\varphi)) \cos^2(\theta)$$

Non-vanished NLO susceptibilities: $d_{11} = 5.8 \times d_{36}(\text{KDP})$ $d_{31} = 0.05 \times d_{11}$
 $d_{22} < 0.05 \times d_{11}$

BBO Sellmeier Equations: (λ in μm)

$$n_o^2 = 2.7359 + 0.01878 / (\lambda^2 - 0.01822) - 0.01354 \lambda^2$$

$$n_e^2 = 2.3753 + 0.01224 / (\lambda^2 - 0.01667) - 0.01516 \lambda^2$$

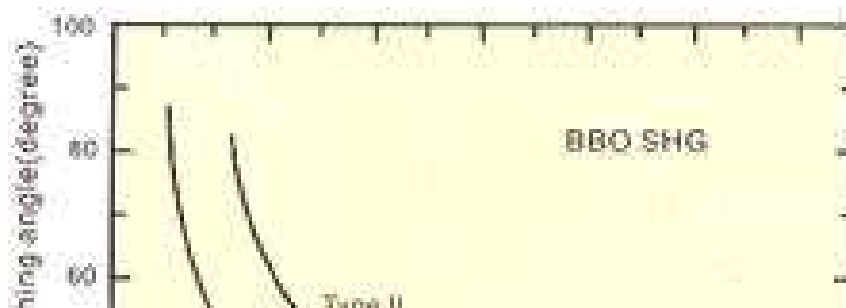
Electro-optic coefficients: $r_{22} = 2.7 \text{ pm/V}$

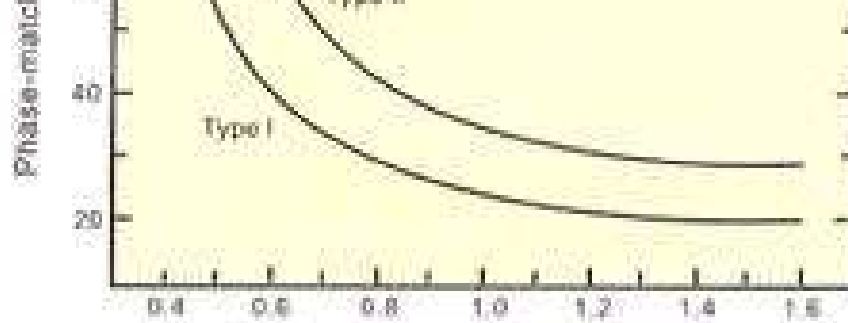
BBO Half-wave voltage: 7KV (at 1064nm, $3 \times 3 \times 20 \text{ mm}^3$)

Resistivity: $> 10^{11} \text{ ohm-cm}$

Applications of BBO Crystal

1. **SHG/THG/FHG/5thHG of Nd:YAG Laser** - BBO is an excellent NLO crystal for frequency doubling, tripling and quadrupling of high power acousto-optic and electro-optic Q-switched and mode-locked Nd:YAG and Nd:YLF lasers. A stable output of more than 15W with conversion efficiency $> 50\%$ green laser can be generated with intracavity SHG by using BBO NLO crystal. BBO is the best NLO crystal to produce the 5th HG at 213nm.

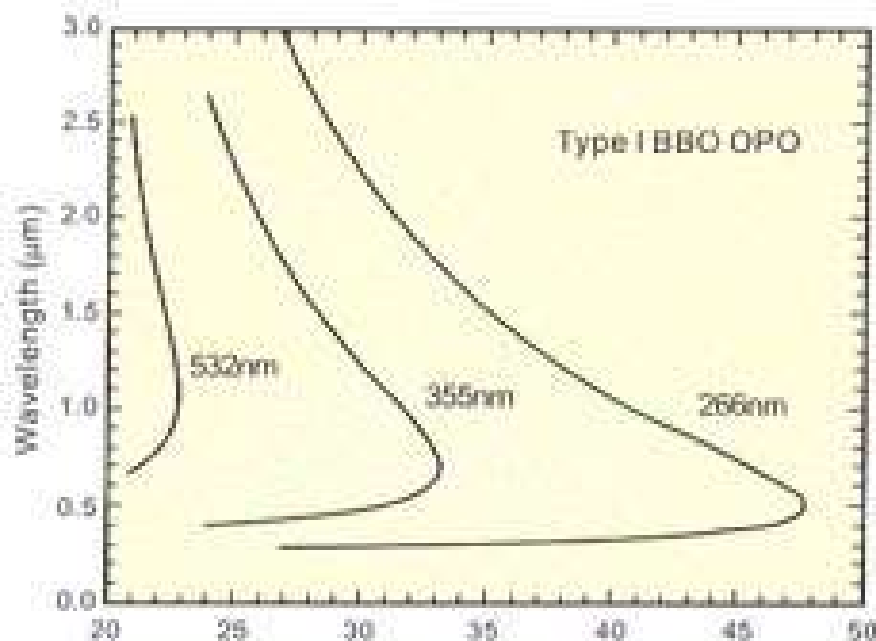




2. **SHG of Ti:Sapphire Laser** - BBO is a prime NLO crystal for frequency doubling, tripling, and quadrupling of ultra-fast Ti:Sapphire Laser. By using a thin BBO NLO crystal, UV laser as short as 6fs can be generated by frequency doubling, tripling an ultra-fast Ti:Sapphire Laser.

3. **SHG of Dye Lasers** - Using a BBO NLO crystal, tunable UV output from 205-310nm can be generated by frequency-doubling an Excimer Laser pumped Dye Laser. BBO conversion efficiency is 4-6 times higher than that of ADP NLO crystal.

4. **SHG of Ar+ Laser** - By intracavity frequency doubling an Ar+ laser, 36 lines of deep UV laser ranging from 228.9nm to 257.2nm can be generated with a Brewster-angle-cut BBO NLO crystal.



5. **OPO/OPA** - BBO's OPO and OPA are powerful tools for generating widely tunable laser from UV to IR. 266nm, 355nm and 532nm pumped BBO's OPO/OPA are widely used in research. For example,

with 40mJ 75ps 532nm pump, an OPO output ranging from 680nm to 2400nm with the peak power of 1.6MW and up to 30% energy conversion efficiency was obtained in a 7.2mm long type I BBO NLO crystal.

6. E-O application - BBO has much higher damage threshold than KD*P or LiNbO₃ NLO crystal. More than 80W output power and 50KHz repetition rate was reached by using BBO NLO crystal and Nd:YVO₄ crystal as gain media. At 5KHz, BBO Q-switch get pulse width as short as 6.4ns, and energy of 5.7mJ or peak power of 900KW. BBO has advantages over the commercial A-O Q-switch, including a very short pulse, high beam quality and compact size. However, BBO has a relative small E-O coefficient, the Half-wave voltage is high (7KV at 1064nm, 3x3x20mm³). Long and thin BBO crystal can reduce the voltage requirement. 25mm long and 1mm thin high optical quality BBO crystal with Z-cut, AR-coated and Gold/Chrome plated on the side faces is supplied in OptoCity.

Specifications of BBO Crystal

Dimension Tolerance: +0/-0.1mm(WxH), +/-0.1mm thickness

Surface Quality: 10-5 Scratch-dig

Flatness: $\lambda/10$ @633nm

Chamfer: 0.1mm@45deg.

Clear Aperture: Central 90% of Diameter

Parallelism: <10 arc seconds

Perpendicular: <10 arc minutes

BBO Orientation Angle: +/-0.5deg.

Damage Threshold: 5GW/cm²@1064nm 10ns, 25GW/cm²@800nm 10fs

Coating: Dual wavelength AR coating: R<0.2%@ ω & R<0.5%@2 ω

P-coating: R<0.7% at central wavelength.

Durability: MIL-M-12508 MIL-C-675C MIL-C-14806 moderate

Durability MIL-M-13508, MIL-C-675C, MIL-C-14800, moderate abrasion

BBO Crystal Cleaning Method: 1:1 of high-purity alcohol and ether on soft silk

BBO crystal order information

Message: *qty. sizes, application(cut-angle), coating...*

Add To Cart for Quote

i.

BBO Crystal Inquiry

Your E-mail:

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Request BBO Crystal

Message with contact information:

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- Thank you! We'll
reply very soon.

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