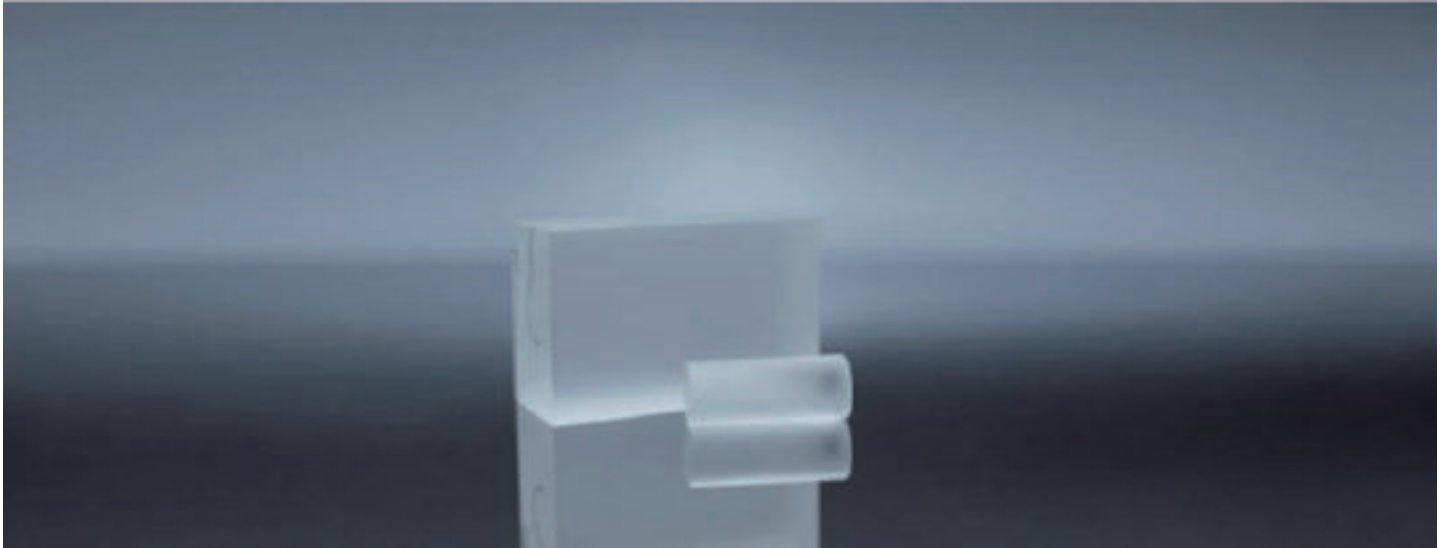


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DESCRIPTION

β -BaB₂O₄ (Barium Metaborate) is a widely used nonlinear crystal for frequency conversion in the UV, visible and NIR. It has large birefringence and low dispersion, high damage threshold, wide phase matching range, good temperature stability, large nonlinear optical effects, and a frequency multiplication factor six times higher than that of KDP crystals. It can be used in Nd:YAG and Nd:YLF lasers for frequency doubling, tripling and mixing of dye lasers, Ti:Sapphire and Alexandrite lasers for frequency doubling, tripling and quadrupling, optical parametric amplifiers (OPA) and optical parametric oscillators (OPO), argon ion, ruby and Cu vapor lasers for frequency doubling, in all-solid-state tunable Laser, ultrafast pulsed laser, deep ultraviolet laser and other high, precise and advanced laser technology fields of research and development.

APPLICATIONS

- Electro-optical crystals for Pukels cells
- 266nm laser for material processing
- 532nm laser for medical applications

FEATURES

- Good physical properties
- Appropriate mechanical properties
- Temperature bandwidth about 55°C
- High optical uniformity: $\delta n \approx 10^{-6}/\text{cm}$
- Transmission range from 190 nm to 3500 nm
- Phase matching range from 6 nm to 3500 nm
- Large effective SHG (second harmonic generation) coefficient
- 100 ps pulse damage threshold of 10 J/cm² at 1064 nm



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PHYSICOCHEMICAL PROPERTIES

Properties	numerical value
chemical formula	BaB ₂ O ₄
crystal structure	Trilateral system, 3M
Lattice parameters	a=b=12.532Å, c=12.717Å, Z=6
Mass density	3.85 g/cm ³
Mohs hardness	4
melting point	Approx. 1095 °C
thermal conductivity	1.2 W/m/K (⊥c); 1.6 W/m/K (/c)
Coefficient of thermal expansion	a,4×10 ⁻⁶ /K; c,36×10 ⁻⁶ /K
Birefringence	Negative uniaxial

NONLINEAR OPTICAL PROPERTIES

attribute	numerical value
SHG phase matching range	409.6~3500nm (Type I); 525~3500nm (TypeII)
NLO coefficient	$d_{11} = 5.8 \times d_{36}(\text{KDP});$
	$d_{31} = 0.05 \times d_{11};$
	$d_{22} < 0.05 \times d_{11}$
	$d_{\text{eff}}(\text{I})=d_{31}\sin\theta+(d_{11}\cos3\varphi-d_{22}\sin3\varphi)\cos\theta$ $d_{\text{eff}}(\text{II})=(d_{11}\sin3\varphi+d_{22}\cos3\theta)\cos2\theta$
Thermooptic coefficient	$dn_o/dT = -9.3 \times 10^{-6}/^{\circ}\text{C}$
	$dn_e/dT = -16.6 \times 10^{-6}/^{\circ}\text{C}$
Electro optic coefficient	$g_{11} = 2.7 \text{ pm/V}, g_{22}, g_{31} < 0.1 g_{11}$
Half wave voltage	48 KV (@ 1064 nm)
Damage threshold is 1.064 μm	5 GW/cm ² (10 ns); 10 GW/cm ² (1.3 ns)
Damage threshold is 0.532 μm	1 GW/cm ² (10 ns); 7 GW/cm ² (250 ps)

LINEAR OPTICAL PROPERTIES

attribute	Numerical value
Transparent range	189 – 3500 nm
absorption coefficient	a<0.1%/cm @1064nm
Refractive Index@1.0642μm	$n_e = 1.5425, n_o = 1.6551$
Refractive index@0.5321μm	$n_e = 1.5555, n_o = 1.6749$
Refractive index@0.2660μm	$n_e = 1.6146, n_o = 1.7571$
Sellmeier equation (λin μm)	$n_o^2(\lambda) = 2.7359+0.01878/(\lambda^2-0.01822)-0.01354\lambda^2$
	$n_e^2(\lambda) = 2.3753+0.01224/(\lambda^2-0.01667)-0.01516\lambda^2$



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EXPERIMENTAL VALUE OF THE INTERNAL ANGLE BANDWIDTH AT T = 293K

Interaction wavelength [μm]	θ_{pm} [deg]	$\Delta\theta^{\text{int}}$ [deg]
SHG, o+o \Rightarrow e		
1.0642 \Rightarrow 0.5321	22.8	0.021
	22.7	0.03
0.5321 \Rightarrow 0.26605	47.3	0.01
0.53 \Rightarrow 0.265	47.6(298K)	0.006
SFG, o+o \Rightarrow e		
1.0641+0.53205 \Rightarrow 0.3547	31.3	0.011
1.0642+0.5321 \Rightarrow 0.35473	31.1	0.015
2.44702+0.5712 \Rightarrow 0.4631	22.1	0.026
2.68823+0.5712 \Rightarrow 0.4711	21.8	0.028
SHG, e+o \Rightarrow e		
1.0642 \Rightarrow 0.5321	32.7	0.034
	32.4	0.046
SFG, e+o \Rightarrow e		
1.0642+0.5321 \Rightarrow 0.35473	38.4	0.02
SFG, o+e \Rightarrow e		
1.0642+0.5321 \Rightarrow 0.35473	58.4	0.05

EXPERIMENTAL VALUE OF PHASE MATCHING ANGLE (T = 293K)

Interaction wavelength (nm)	θ_{exp} [deg]
SHG, o+o \rightarrow e	
400 \rightarrow 200	90
415 \rightarrow 207	79.2
476 \rightarrow 328	57
510 \rightarrow 255	50
532 \rightarrow 266	47.3
604 \rightarrow 302	40
710 \rightarrow 355	33
780 \rightarrow 390	30
800 \rightarrow 400	26.5
946 \rightarrow 473	24.9
1064 \rightarrow 532	22.7
SHG, e+o \rightarrow e	
532 \rightarrow 266	81
710 \rightarrow 355	48
1064 \rightarrow 532	32.4



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SPECTRA

