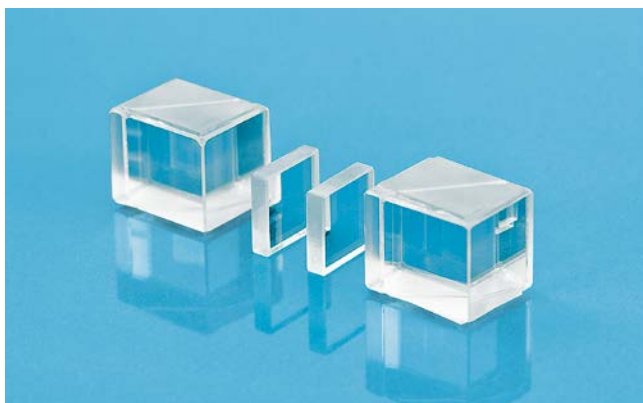


BaF₂ OPTICAL CRYSTALS FOR CROSS POLARIZED WAVE GENERATION



Cross-Polarized Wave (XPW) generation is a nonlinear third order process during which fundamental and generated waves have the same frequency; however, generated wave is perpendicularly polarized to pump wave polarization. Phase matching occurs over large bandwidth in XPW generation process. This means the same phase and group velocities for fundamental wave and XPW.

Cross-polarized wave (XPW) generation process is driven by the third order nonlinearity of the crystal, $\chi_{xxxx}^{(3)}$ and the anisotropy $\sigma = (\chi_{xxxx}^{(3)} - 3\chi_{xyxy}^{(3)}) / \chi_{xxxx}^{(3)}$ of the $\chi^{(3)}$ tensor.

The typical optical material used for cross-polarized wave (XPW) generation is Barium Fluoride (BaF₂) crystal with z ([001]) or holographic ([011]) crystallographic orientation. Theory predicts a maximum XPW energy conversion efficiency around 35% when using [011]-cut BaF₂ crystal with a concomitant pulse shortening factor of $\sqrt{3}$ corresponding to a pure third-order nonlinear process [1].

EKSMA OPTICS offers [011] orientation BaF₂ optical crystals (XPW crystals) for Cross-Polarized Wave (XPW) generation. BaF₂ optical crystals with orientation [001] as well CaF₂ optical crystals are available on request.

Physical properties

Crystal type	cubic
Density, g/cm ³	5.27
Melting point, °C	1525
Refractive index	@ 0.265 μm , n = 1.51217 @ 10.3 μm , n = 1.39636
Transmission range, μm	0.135 – 15

Specifications

Material	BaF ₂
Surface quality	60 – 40 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.0 / -0.25 mm
Thickness tolerance	± 0.2 mm
Surface flatness	$\lambda/2$ @ 633 nm
Parallelism	3 arcmin

Characteristics of the different Cross Polarized Wave (XPW) crystals at 2.1 μm [2]

	BaF ₂	CaF ₂	CVD-Diamond
Orientation	h-cut [011]	h-cut [011]	z-cut [001]
Length, mm	2	2	1.2
n	1.464	1.426	2.383
$\chi_{xxxx}^{(3)} \cdot 10^{-22} \text{ m}^2/\text{V}^2$	1.53	0.94	11
σ	-1.2	-0.6	-1.8
GVD, fs ² /mm	-6	-27	63

[1] L. Canova, S. Kourtev, N. Minkovski, A. Jullien, R. Lopez-Martens, O. Albert, and S.M. Saitel, Appl. Phys. Lett. 92, 231102 (2008)

[2] Ricci, A., Silva, F., Jullien, A., Cousin, S. L., Austin, D. R., Biegert, J., Lopez-Martens, R. Generation of High-Fidelity few-cycle pulses at 2.1 μm via cross-polarized wave generation. Optics Express 9711, 2013.04.22. Vol. 21, No. 8. DOI:10.1364/OE.21.009711

UNMOUNTED

Size, mm	Thickness, mm	Orientation	Catalogue number	Price, EUR
10x10	0.5	[011]	540-7105	180
10x10	1.0	[011]	540-7110	180
10x10	1.5	[011]	540-7115	180
10x10	2.0	[011]	540-7120	180
10x10	2.5	[011]	540-7125	180
10x10	3.0	[011]	540-7130	180

MOUNTED INTO OPEN RING HOLDER

Size, mm	Thickness, mm	Orientation	Catalogue number	Price, EUR
10x10	0.5	[011]	540-7105M	230
10x10	1.0	[011]	540-7110M	230
10x10	1.5	[011]	540-7115M	230
10x10	2.0	[011]	540-7120M	230
10x10	2.5	[011]	540-7125M	230
10x10	3.0	[011]	540-7130M	230