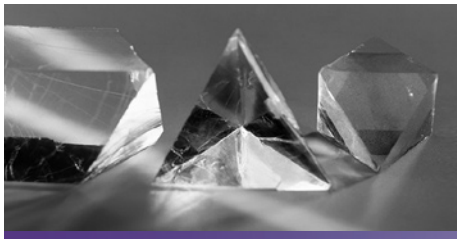




Barium Fluoride

VIS/IR applications



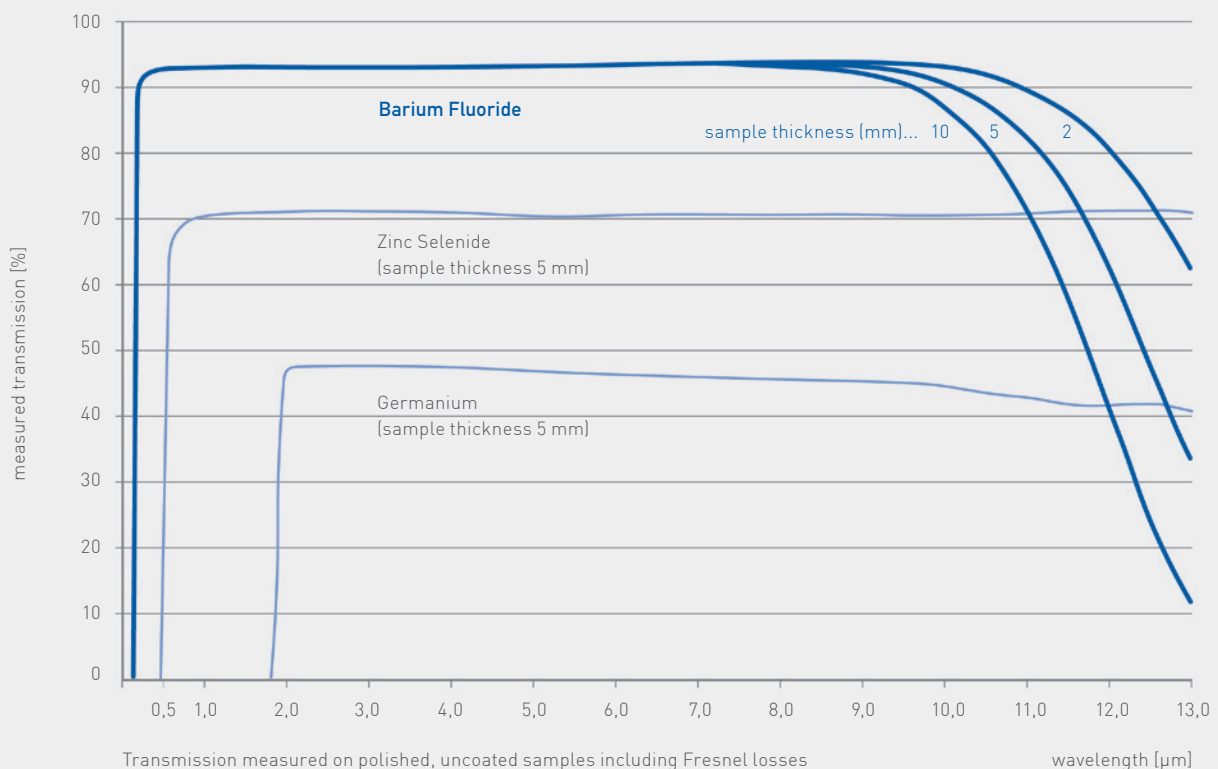
Barium Fluoride

Hellma Materials Barium Fluoride is the material of choice for wide bandwidth applications covering the VIS, near-IR and mid-IR range. It is an optical crystal grown from highly purified synthetic raw material and features a superior internal transmittance ($T > 99\%$ @ $7\mu\text{m}$) enabling advanced applications in thermal imaging, night vision and surveillance imaging using integrated VIS and IR detector channels. Low spectral dispersion makes BaF_2 the preferred optical material for aberration and color correction.

Products

Delivery forms	cut/ground blanks, blocks, rods, prisms
Crystallinity	polycrystalline or monocrystalline
Diameter	max. 380 mm (polycrystalline), max. 200 mm (monocrystalline)
Thickness	max. 250 mm (polycrystalline), max. 150 mm (monocrystalline)
Crystal orientation	$\langle 111 \rangle$, random, others upon request

Spectral Transmission BaF_2



Properties of Barium Fluoride

Refractive indices n (at 22.6°C (± 0.3°C))	
λ [μm]	n
1.0	1.46861
2.0	1.46464
3.0	1.46119
4.0	1.45671
5.0	1.45103
6.0	1.44398
7.0	1.43561
8.0	1.42579
9.0	1.41435
10.0	1.40131
11.0	1.38660

λ relative to air, tolerance of refractive indices: ± 1 x 10⁻⁴

Abbe number ⁽¹⁾	
v _d = 81.61	v _e = 81.02

Sellmeier dispersion formula for refractive indices			
$n^2 - A = B_1 \lambda^2 / (\lambda^2 - C_1) + B_2 \lambda^2 / (\lambda^2 - C_2) + B_3 \lambda^2 / (\lambda^2 - C_3)$			
A	1.0168129		
B ₁	6.1678999 x 10 ⁻¹	C ₁	2.9633956 x 10 ⁻⁷
B ₂	5.1676079 x 10 ⁻¹	C ₂	1.2533512 x 10 ⁻¹
B ₃	4.5065782	C ₃	50.142897

Valid for λ = 1 μm to 11 μm at 22.6°C (± 0.3°C), relative to air

Thermal coefficient of refractive index	
Wavelength [μm]	dn/dT [K ⁻¹] @ 300K ⁽⁵⁾
0.5	-1.65 x 10 ⁻⁵
5.0	-1.60 x 10 ⁻⁵

Chemical properties	
Solubility in water @ 23°C [g/100g]	0.17
Molecular weight	175.3
Crystal type	single crystal, synthetic
Crystal structure	cubic
Cleavage planes	{111}
Lattice constant [nm]	0.6196

Thermal properties	
Melting point [°C]	1386
Specific heat capacity [J/(kg K)] ⁽²⁾	410
Thermal conductivity @ 13°C [W / (m K)]	11.72
Linear thermal expansion coefficient @ 0°C [10 ⁻⁶ / K]	18.1

Mechanical properties	
Young's Modulus E @ 25°C [GPa] ⁽²⁾	53.07
Shear Modulus G @ 25°C [GPa] ⁽²⁾	25.4
Bulk Modulus K @ 25°C [GPa]	56.4
Poisson Ratio μ	0.343
Knoop Hardness ⁽⁴⁾	82
Mohs Hardness	3
Density [g/cm ³]	4.89

References

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- (2) D. Girlich; Elastic Constants of BaF₂; Phys.Rev. Vol135, p1826, 1964
- (3) I.H. Malitson; J.Opt.Soc.Am. Vol52, p1377, 1962
- (4) S. Ballard et al; J.Opt.Soc.Am. Vol42, p684, 1952
- (5) B. Leviton et al, Proc. of SPIE Vol. 5904, 2005

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