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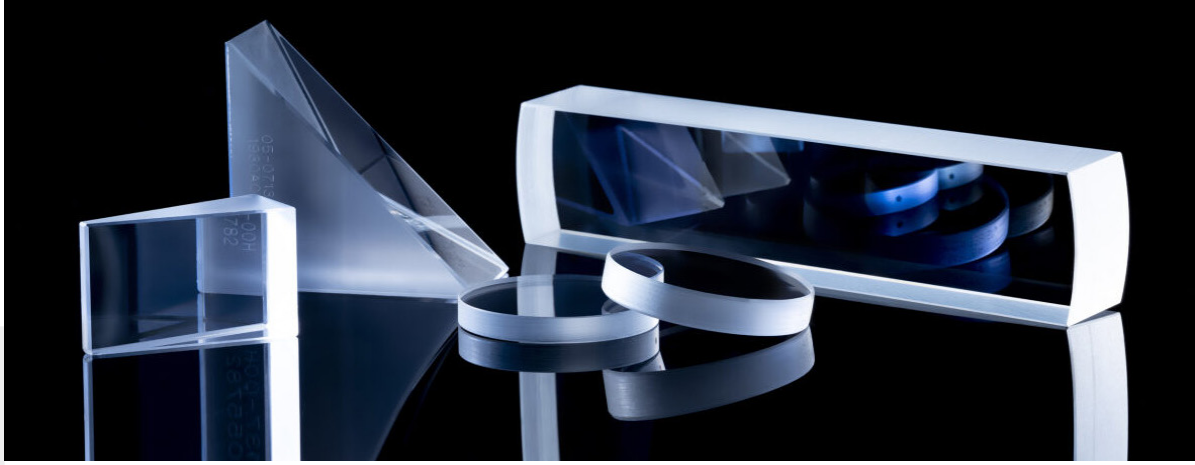

Corning® Laser Durable Grade™ Calcium Fluoride

Corning/ Advanced Optics
January 2024

Laser Durable Grade™ Calcium Fluoride Data Sheet

High Quality Calcium Fluoride Optimized for Microlithography and Laser Optics Applications

Corning Advanced Optics is a trusted, premier supplier of calcium fluoride crystal components. For harsh laser exposure levels, or where maximizing optic lifetime and equipment uptime are critical, Corning® Laser Durable Grade™ CaF_2 is optimized to be the material of choice. Corning offers a range of geometries and finishes, including complex multi-faceted and highly polished parts. With its comprehensive coating engineering expertise, Corning also provides design engineering, fabricating, polishing, and coating capabilities. Let Corning be the supplier of choice for your most complex laser optic requirements.

Products

- Windows
- Prisms
- Lenses
- Beam Splitters
- Optical Modules
- Mirrors

Surface Finishes

Industry leading metrology to assure:

- Low surface roughness (<4 Å) with < 10/5 cosmetics
- Ultra-low sub surface damage
- Wavefront errors <1/10 wave
- Surface cleanliness to enable high laser durability

Custom Coatings

- Anti-Reflective
- Highly Reflective
- Partially Reflective
- Low Absorption
- Protective/Enhanced Durability
- Custom Solutions Upon Request

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Corning® Laser Durable Grade™ CaF_2

Physical and Chemical Properties

Molecular Weight	78.075 g/mol
Crystal Structure	Cubic, fluorite type, space group Fm3m
Lattice Constant	5.462 Angstroms
Cleavage Plane	(111)
Density	3.18 g/cm³ at 25°C
Melting Point	1420°C
Thermal Conductivity	9.71 W/(mK) at 25°C
Dielectric Constant	6.76 at 1 MHz

Mechanical and Elastic Properties

Young's Modulus (E)	146 GPa <100>, 89.6 GPa <111>
Shear Modulus (G)	60.4 GPa <100>
Bulk Modulus (K)	84.8 GPa
Poisson's Ratio	0.21 <100>
Elastic Compliance (x 10^{-2} /GPa)	S_{11} = 0.6829 S_{12} = -0.1448 S_{44} = 2.9563
Elastic Stiffness (x 10^2 GPa)	C_{11} = 1.653 C_{12} = 0.445 C_{44} = 0.338
Knoop Hardness (200 gram load)	156 - 168 kg/mm² (111)

CaF_2 Refractive Index

Refractive Index of CaF_2 measured in 1 atm of N_2

λ (nm)	Spectral Line	Measured 20°C	Measured 25°C	dn/dT x 10^{-6} K^{-1}
2326.05		1.42213	1.42208	-9.6
1530.00		1.42614	1.42609	-10.4
1060.00		1.42853	1.42609	-10.2
852.34	[s]	1.43004	1.42999	-10.4
656.45	[C]	1.43247	1.43242	-10.2
644.03	[C']	1.43269	1.43264	-10.1
632.98		1.43290	1.43285	-10.1
592.00		1.43376	1.43371	-10.0
589.30	[D]	1.43382	1.43377	-10.0
587.60	[d]	1.43386	1.43381	-10.0
546.23	[e]	1.43495	1.43490	-9.6
486.30	[F]	1.43702	1.43698	-9.8
480.13	[F']	1.43728	1.43724	-9.8
435.96	[g]	1.43948	1.43943	-9.4
365.12	[i]	1.44490	1.44485	-9.6
334.24		1.44850	1.44845	-8.8
289.44		1.45618	1.45614	-8.4
253.73		1.46600	1.46596	-7.6
248.35		1.46792	1.46789	-7.3
228.87		1.47637	1.47634	-6.6
214.51		1.48457	1.48454	-5.6
206.27		1.49033	1.49030	-5.0
194.23		1.50061	1.50059	-3.8
193.37		1.50144	1.50143	-3.9
184.95		1.51056	1.51055	-3.2

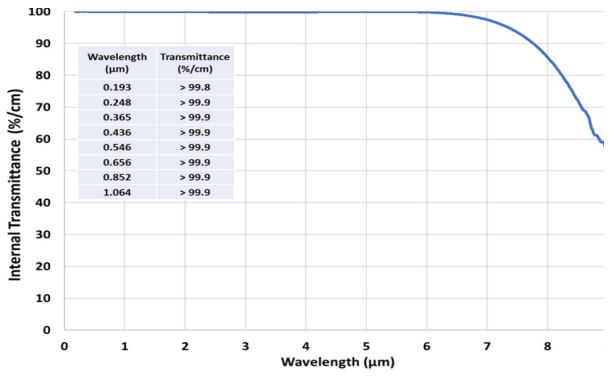
Additional Information

Depending on customer requirements, Corning can provide solutions ranging from crystal blanks to complete turnkey optical packages. Corning can precisely manufacture a wide variety of laser optic components including: windows, prisms, mirrors, plano convex, plano concave, and hemispherical optics. With its comprehensive coating engineering expertise, Corning can customize final optical performance to enhance transmission, reflectivity, and/or laser durability to customer specification in order to provide a comprehensive optical path solution.

Additional Properties

Internal Transmittance	> 99.8 %/cm @ 193 nm > 99.9 %/cm @ 248 nm
Stress Birefringence	< 2 nm/cm or < 5 nm/cm (max), [111], measured @ 592 nm
Bubbles/Inclusions	ISO 10110 - 1/1 x 0.02
Orientation	(111) ± 3° typical, others upon request

Internal Transmittance DUV-VIS-IR Region



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