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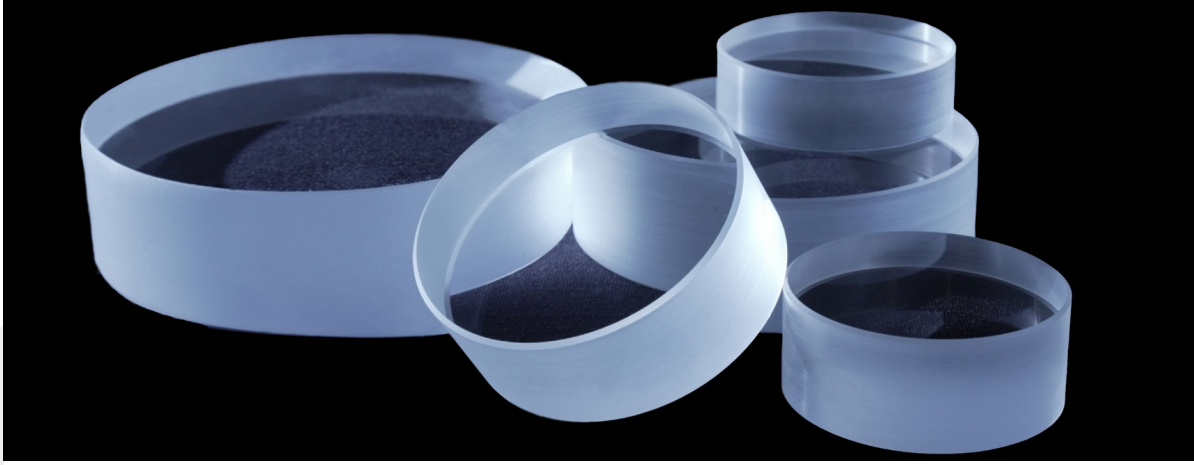

Corning® Optical Grade Calcium Fluoride

Corning/ Advanced Optics
January 2024

Optical Grade (OptG CaF_2) Data Sheet

High Quality Calcium Fluoride Optimized for Imaging Applications

Corning Advanced Optics is a trusted, leading supplier of calcium fluoride crystal materials. We have expanded our calcium fluoride portfolio to include Corning® Optical Grade Calcium Fluoride (OptG CaF_2). Calcium Fluoride ingots are grown using Corning's proprietary highly purified material process, ensuring a consistent supply of high-quality single crystals. Corning® OptG CaF_2 is available as prefinished blanks or precision polished parts, meeting stringent optical requirements.

The following data applies to a typical sample of Corning® OptG CaF_2 :

Key Attributes

Feature	Typical Capability*
Internal Transmittance	>99.8 %/cm @ 193 nm, >99.9 %/cm @ 248 nm
Refractive Index Homogeneity (P-V)	≤ 5 ppm to ≤ 2 ppm, [111], @ 633 nm
Stress Birefringence (P-V)	≤ 5 nm/cm to ≤ 2 nm/cm, [111], @ 592 nm
Bubbles/Inclusions	ISO 10110-3 1/2 x 0.063
Orientation	(111) ±3° typical, *others are available upon request*
Available Diameters	Up to 90 mm diameter, others are available upon request
Surface Finish	Saw cut, fine ground, or polished

*Customized specifications are available upon request.

Quality Grade Selection Chart

Optical Grade Material Classification	Refractive Index Homogeneity (ppm, P-V)	Stress Birefringence (nm/cm, P-V)
OP-5	≤ 5	≤ 5
OP-3	≤ 3	≤ 3
OP-2	≤ 2	≤ 2
OP-1	Additional data available upon request	

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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)

Optical Properties

Transmission Range	0.12 µm to 9 µm
Energy Gap	10 eV
193 nm Absorption Coefficient (0 Fluence)	< 2E-3 cm^{-1}
193 nm 2-Photon Absorption Coefficient	< 2.5E-9 cm/W
Photoelasticity (546.38 nm)	q_{11} = -0.38 x 10^{-12} Pa^{-1} q_{12} = 1.15 x 10^{-12} Pa^{-1} q_{44} = 0.75 x 10^{-12} Pa^{-1} (q_{11} - q_{12}) = -1.53 x 10^{-12} Pa^{-1}
Abbe Number (at 25°C)	V_d = 95.22 V_e = 94.68

Linear Thermal Expansion Coefficient

Temperature	**Coefficient [x 10^{-6} K^{-1}]**
0 to 25 °C	18.5
25 to 50 °C	19.0
50 to 100 °C	19.6
100 to 150 °C	20.5
150 to 200 °C	21.6

Polynomial Dispersion Formula

(relative, N2, 20-25 °C, 2326 nm - 185 nm)
$dn/dT = (C_0 + C_1\lambda^2 + C_2\lambda^{-2} + C_3\lambda^{-4} + C_4\lambda^{-6}) \times 10^{-6}$, with λ in µm

C_0	-1.059200E+01
C_1	1.543519E-01
C_2	1.515306E-01
C_3	2.230264E-03
C_4	4.820581E-05

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

Sellmeier Dispersion Formula

(relative, N_2, 2326 nm - 185 nm)
$n^2-1 = A_1\lambda^2/(\lambda^2-B_1) + A_2\lambda^2/(\lambda^2 - B_2) + A_3\lambda^2/(\lambda^2 - B_3) + A_4\lambda^2/(\lambda^2 - B_4)$ with λ in µm

	Sellmeier Dispersion Coefficients (20 °C)	Sellmeier Dispersion Coeffcients (25 °C)
A_1	4.430595147E-01	4.463112200E-01
A_2	4.454624348E-01	4.408035972E-01
A_3	1.52595301E-01	1.515166998E-01
A_4	8.859807728E+00	8.853841319E+00
B_1	1.733873966E-03	1.752260093E-03
B_2	7.938987382E-03	7.970736905E-03
B_3	1.234337898E-02	1.231282897E-02
B_4	2.751117861E+03	2.751117881E+03

Internal Transmittance DUV-VIS-IR Region