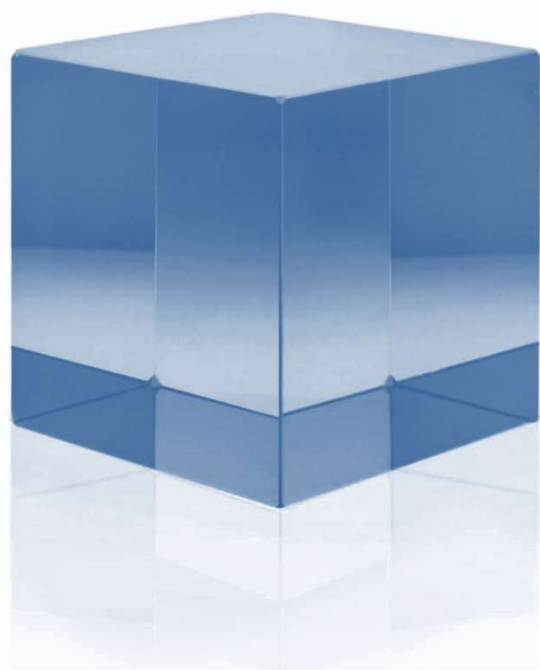


Calcium Fluoride

德硅凯氟
DESIOPTOE

CaF₂ Datasheet



DESIOPTOE is a distinguished fluoride crystal supplier. With DESIOPTOE's exceptional highly purified material process, increased the durability of CaF₂ crystal in long-term exposure on high-power UV lasers, Making it an advance choice for Microlithography, Excimer lasers and other ultraviolet applications.

Due to a very good transmittance performance from DUV – Visible – Infrared, and being physical stable, chemically inert with superior hardness, Calcium Fluoride crystal can be widely used in a variety of applications like astronomy, photography, HDTV zoom lenses, microscopy, IR system, spectrometer and medical lasers etc.

DESIOPTOE provides CaF₂ blanks and components. DESIOPTOE's ingot diameter up to 320mm and with a thickness exceeding 80 mm.

Standard (111) (001) orientations are offered, other custom orientations request can be supported.

KEY ADVANTAGE

Excellent broadband transmittance

High laser durability

Low stress birefringence

Excellent UV transmittance

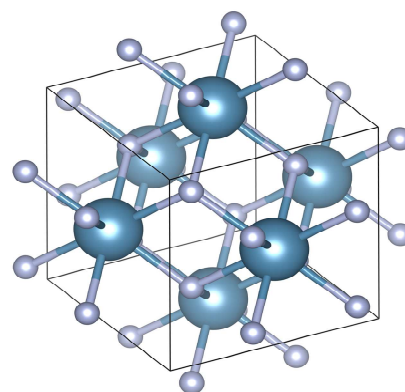
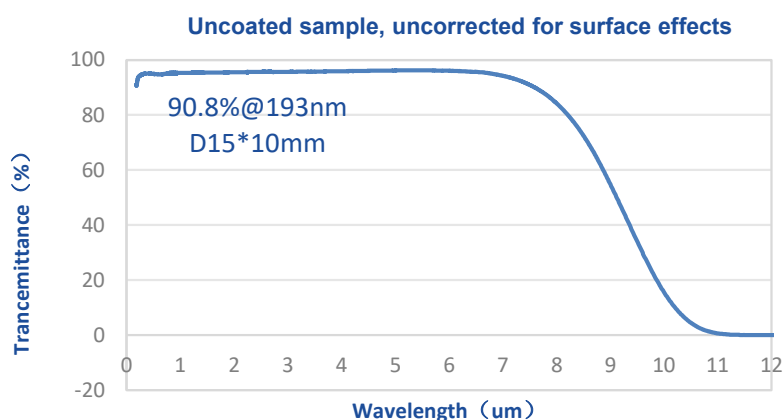
High refractive index homogeneity

General Grades

DESIOPTOE Calcium Fluoride crystal material classified in the flowing general grades:

Material Grade	Internal Transmittance	Laser Durability	Birefringence	Recommended Wavelength
CAF - A	>99.5%@193nm	LD-1	1-10nm/cm on request	ArF excimer laser (193nm)
CAF - B	>99.8%@248nm	LD-2		KrF excimer laser (248nm)
CAF - C-I	>99.8%@365nm	LD-3		i-line 356nm
CAF - C-II	>99.8%@365nm	~		UV region
CAF - D-I	~	~		VIS region, IR region

DESIOPTOE Calcium Transmission



Physical Properties

Crystal Structure	Cubic, Fluoride type
Cleavage Plane	(111)
Lattice Constant	0.546342
Molecular Weight	78.08 g/mol
Density	3.18 g/cm ³
Melting Point	1420 °C
Solubility	0.016 g/l H ₂ O at 20 °C

Thermal Properties

Thermal Conductivity	9.70 W/(m . K)
Specific Heat Capacity	0.893 J/(g . K)
Thermal Diffusivity	35.6 10 ⁻⁷ m ² /sec
Linear Thermal Expansion Coefficient	20.8 10 ⁻⁶ /K at (20 ~ 300 °C) 18.41 10 ⁻⁶ /K at (-30 ~ 70 °C) 18.5 10 ⁻⁶ /K at (0 ~ 25 °C)

Chemical/Electrical Properties

Dielectric Constants	6.81 at 27 °C
Climatic Resistance class	CR 1
Acid Resistance class	SR 4.5
Alkali Resistance class	AR 2.3
Phosphate Resistance class	PR 1.3
Stain Resistance class	FR 0

Mechanical Properties

Bulk Modulus	(GPa)	83.8
Shear Modulus	(GPa)	34.6
Young's Modulus	(GPa)	<100> 146 <110> 101 <111> 91
Poisson Ratio	μ	0.343
Knoop Hardness		82
Mohs Hardness		4

Optical Properties

$n_d = 1.43384$
 $n_e = 1.43492$
 $v_d = 95.23$
 $v_e = 94.96$
 $N_F - N_C = 0.00456$
 $N_{F'} - N_{C'} = 0.00459$

Refractive Indices

Measured at 22 °C, Nitrogen gas, 1013hPa

	$\lambda_{vac}[nm]$	n	$\Delta n/\Delta T(N_2)[10^{-6}/K]$
n_{2325}	2325.59	1.42212	—
n_{1970}	1970.56	1.42401	—
n_{1530}	1530	1.42612	—
n_{1060}	1060	1.42851	—
n_t	1014.25	1.42879	-9.6
n_s	852.35	1.43002	-9.7
n_r	706.71	1.43166	-9.7
n_c	656.45	1.43245	-9.8
$n_{c'}$	644.03	1.43267	-9.8
n_{He-Ne}	632.98	1.43288	-9.8
n_D	589.46	1.4338	-9.8
n_d	587.73	1.43384	-9.8
n_e	546.23	1.43493	-9.8
n_F	486.27	1.43701	-9.8
$n_{F'}$	480.13	1.43726	-9.8
n_g	435.96	1.43948	-9.7
n_h	404.77	1.44149	-9.6
n_i	365.12	1.44488	-9.4
n_{334}	334.24	1.44848	-9.1
n_{312}	312.66	1.45173	-8.8
n_{296}	296.82	1.45463	-8.5
n_{280}	280.43	1.45824	-8.1
n_{248}	248.35	1.46791	-6.9
n_{194}	194.23	1.5006	-3.2
n_{193}	193.37	1.50143	-3.2
n_{184}	184.95	1.51055	-2.5
$n_{157^{**}}$	157.63	1.55927	—

Relative Partial Dispersion

Deviation of Relative Partial Dispersion

$P_{s,t}$	0.2698		
$P_{C,s}$	0.5333	$\Delta P_{C,t}$	-0.194
$P_{d,c}$	0.3046	$\Delta P_{C,s}$	-0.092
$P_{e,d}$	0.2388	$\Delta P_{F,e}$	0.0183
$P_{g,F}$	0.5389	$\Delta P_{g,F}$	0.0552
$P_{i,h}$	0.7462	$\Delta P_{i,g}$	0.2636

Optical fabrication capacity

DESIOPTOE also offers a variety of fabrication such as grinding, polishing and coating, that making DESIOPTOE not only provide CaF₂ crystal ingots and blanks, DESIOPTOE also provide customized optical components.

Internal Transmittance	>99.8%@248nm
Bubbles/Inclusions	ISO 10110 – 1 x 0.02
Scratch/Dig Limit	10-5
Micro-roughness Limit	≤ 0.5 nm
Available blanks diameters	up to 320mm
Wavefront errors Limit	$\lambda/10$
Orientation	(111) (001) (100) orientation are offered
Finish	TSK/rope cut, fine grinded, polished, coated
Components	window, wedge, prism, plano-convex, plan- concave, biconvex, biconcave, convex-concave
Coatings	Anti-reflective, highly reflective

