

Nikon NICF Series Calcium Fluoride

NICF Series ADVANTAGES

High laser durability

Nikon's strict process control and use of ultra-high-purity raw materials during the calcium fluoride growing process results in increased durability to long-term exposure to high-power excimer lasers.

High quality crystals

Nikon is a leading supplier of large-sized, high-quality single crystal calcium fluoride. With our continuous process improvement cycle and optimized growing conditions, we can produce material with minimal lattice and structural defects, resulting in increased laser durability.

High refractive index homogeneity

Nikon's proprietary annealing process yields unsurpassed refractive index homogeneity.

Optical grades

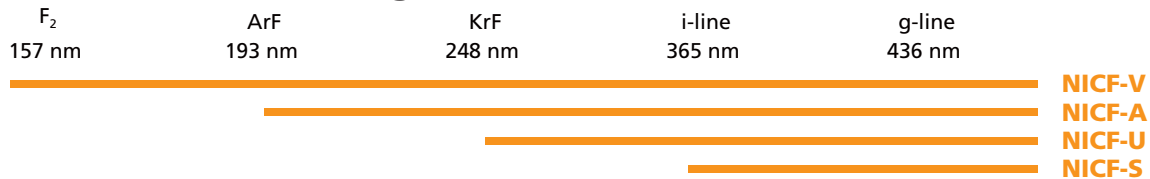
Grade	Internal transmittance [%] Sample thickness: 10 mm	Laser durability	Birefringence	Recommended wavelength
NICF-V	≥ 99.5 (at 157 nm)	A	2 - 20 nm/cm	VUV region, ArF excimer laser
NICF-A	≥ 99.8 (at 193 nm)	B	on request	ArF excimer laser (193 nm)
NICF-U	≥ 99.8 (at 248 nm)	C		KrF excimer laser (248 nm)
NICF-S	—	—	—	UV region, Visible region, IR region

※ Crystal orientation to be specified by the customer, <111>, random and custom orientations are available upon request.

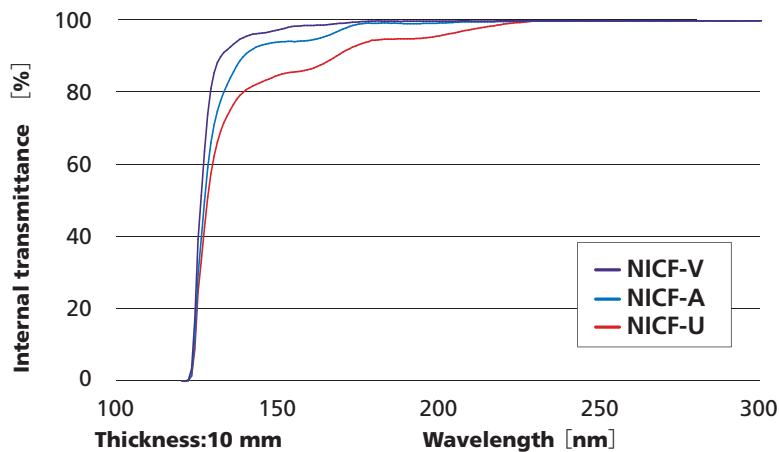
※ Values stated above are valid for material with a diameter of 30 - 260 mm and a thickness of 5 - 50 mm. Material outside this range will be regarded as custom.

※ Laser durability is classified into three groups, A, B and C, with NICF-V represents the highest grade of material available.

NICF Transmittance range



Transmittance data — VUV-UV region —



NICF Available range of homogeneity



Properties of NICF-V, A, U (Nikon Calcium Fluoride)

Refractive Indices

	Wavelength [nm]	Refractive Index
He	1082.989	1.42837
t	1013.98	1.42880
s	852.11	1.43003
A'	768.195	1.43088
r	706.519	1.43167
C	656.273	1.43246
C'	643.847	1.43268
He-Ne	632.8	1.43288
D	589.294	1.43380
d	587.562	1.43384
e	546.074	1.43493
F	486.133	1.43701
F'	479.992	1.43727
g	435.835	1.43947
h	404.656	1.44149
i	365.015	1.44489
KrF	248.3	1.46791
ArF	193.4	1.50135

Measured at
 Temperature : 22.5 °C
 Humidity : 50 %
 Atmospheric pressure : 1013 hPa

Optical Properties

n_d (He, 587.56 nm)	1.43384
n_e (Hg, 546.07 nm)	1.43493
$n_F - n_C$	0.00456
$n_{F'} - n_{C'}$	0.00459
γ_d	95.2
γ_e	94.9

Mechanical Properties

Density	3.18 g/cm ³
Knoop Hardness (ISO9385)	158.3
Abrasion **	334
Young's Modulus	75.8 GPa
Shear Modulus	33.7 GPa
Poisson's Ratio	0.26

Physical / Electrical / Chemical Properties

Crystal Structure	Cubic, Fluorite type	
Cleavage Plane	{111}	
Molecular Weight *	78.08	
Solubility in Water *	20 °C	0.016 g/ℓ
Dielectric Constants ϵ_r *	27 °C	6.81
Water Resistance ***	Class 4	
Acid Resistance ***	Class 1	
Weathering	Class 1	

Thermal Properties

Melting Point *	1420 °C	
Linear Thermal Expansion Coefficient	20 - 60 °C	187 · 10 ⁻⁷ /K
Thermal Conductivity *	0 °C	10.3 W/m · K
Heat Capacity *	298 K	71.13 J/K · mol
	1000 K	90.49 J/K · mol
	1500 K	123.7 J/K · mol

* Excerpts from literature
 ** Measuring method : JOGIS 10
 *** Measuring method : JOGIS 06

※We show each property as typical value.





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