



# OPTICAL MATERIALS

# Synthetic Silica Glass

[NIFS Series]

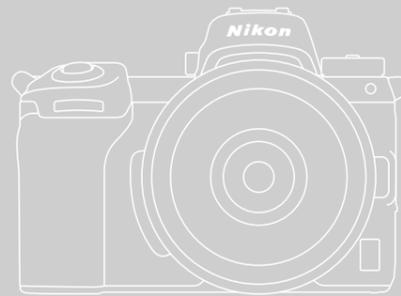


Silica glass stands out among optical materials that offer various properties and capabilities. It provides the highest standards of purity, homogeneity, and laser durability. Nikon Synthetic Silica Glass (SiO<sub>2</sub>), NIFS series, features high refractive index homogeneity, high transmittance, and superior excimer laser durability. Nikon has the capability of factoring in any material-grade specification, or mass-production quality using its proprietary accurate-analysis technology and material measurement to meet our customer requirements and exceed expectations.

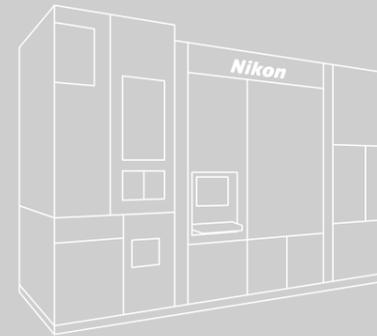
Nikon optics are used in various fields. Nikon optics are not limited to our own cameras and lithography systems. It is also used in various fields such as 3D Printers, Optical Systems, Interferometers, Laser Processing Machines, and so on.



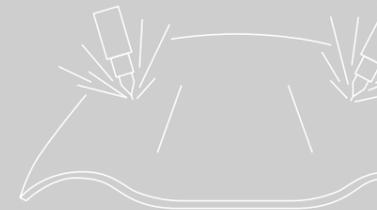
Image Measuring System



Camera



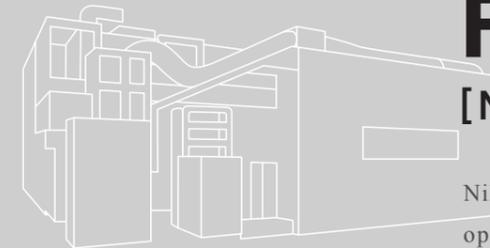
Semiconductor Lithography System



Laser Processing Machine



3D Printer



FPD Lithography System



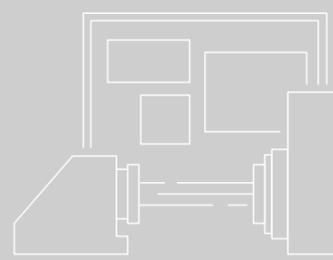
# Calcium Fluoride

[NICF Series]

Nikon Calcium Fluoride, NICF Series, are single-crystal optical material that features high homogeneity in its refractive index, high transmittance, and high durability from Excimer Laser to Vacuum Ultraviolet Lasers. Nikon Calcium Fluoride was originally developed to accommodate optics for Illumination System and/or Projection Lens System on our Semiconductor Lithography System. While working with calcium fluoride to match our customer requirements, Nikon has the capability of factoring in any material-grade specification and mass-production criterion using proprietary accurate-analysis and measurement.



Optical System



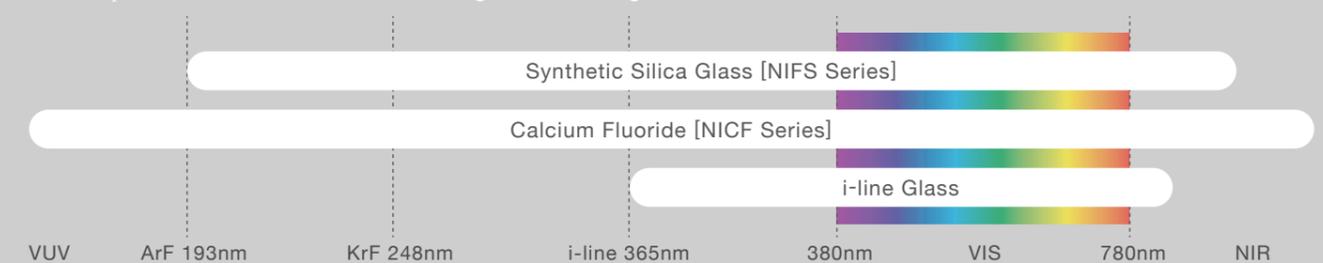
Interferometer



# i-line Glass

Together with Nikon Optical Design, we have been Researching and Developing high-quality optics and optical products. Nikon i-line Glass was developed to be used in our i-line (365 nm) semiconductor lithography systems. It delivers high transmittance and superior homogeneity, even with large diameter optics.

Nikon optical materials cover a wide range of wavelengths.



# Synthetic Silica Glass

[NIFS Series]



# Calcium Fluoride

[NICF Series]



## Applications

Ultraviolet and High-Power Laser Optics  
 Semiconductor and FPD Lithography System Lenses and Optics  
 Industrial Inspection System Lenses and Optics  
 Synthetic Silica Glass Wafers  
 Various Device Substrates (e.g. TFT, CCD, etc.)  
 Astronomy Optics  
 Healthcare, Medical System Optics  
 Semiconductor Manufacturing Equipment Optics  
 Semiconductors/FPD Synthetic Silica Photomask Substrates

## Lineup

Grade	Internal Transmittance [%] Sample thickness: 10 mm	Birefringence	Striae	Recommended Wavelength
NIFS-V	99.9 (at 193 nm)	1~10 nm/cm on request	3D	ArF (193 nm)
NIFS-A	99.9 (at 193 nm)		3D 1D	ArF (193 nm)
NIFS-U	99.9 (at 248 nm)		3D 1D	KrF (248 nm)
NIFS-S	99.9 (at 365 nm)		3D 1D	UV region, Visible region
NIFS-I	-		-	-

Striae free in three directions (all directions) or Striae free in one direction can be selected along with its Striae grade.



## Applications

Ultraviolet and High-Power Laser Optics  
 Semiconductor and FPD Lithography System Lenses and Optics  
 Industrial Inspection System Lenses and Optics  
 Camera Lenses  
 Astronomic Optics

## Lineup

Grade	Internal Transmittance [%] Sample thickness: 10 mm	Birefringence	Recommended Wavelength
NICF-V	≥99.5 (at 157 nm)	2~20 nm/cm on request	VUV region, ArF (193 nm)
NICF-A	≥99.8 (at 193 nm)		ArF (193 nm)
NICF-U	≥99.8 (at 248 nm)		KrF (248 nm)
NICF-S	-		UV region, Visible region, IR region

Crystal Orientation and Various Properties are selectable.

# i-line Glass



## Applications

Semiconductor and FPD Lithography System Lenses and Optics  
 Industrial Inspection System Lenses and Optics  
 Various Inspection/Measurement System Lenses and Optics

## Lineup

Glass type	Refractive index $n_d$	Dispersion $v_d$	10 mm internal transmittance [%] (365 nm) $\tau_i$	Refractive index $n_i$	Single lot variation $n_i (\times 10^{-5})$	Solarization
4786	1.47410	86.8	99.8	1.48726	2	Good
5165	1.51183	65.0	99.8	1.53073	10	Good
5742	1.57653	42.1	99.6	1.61265	2	Good
5859	1.59042	59.5	99.7	1.61450	2	Good
7054	1.70623	54.7	99.4	1.73811	10	Good

10 mm Internal Transmittance:

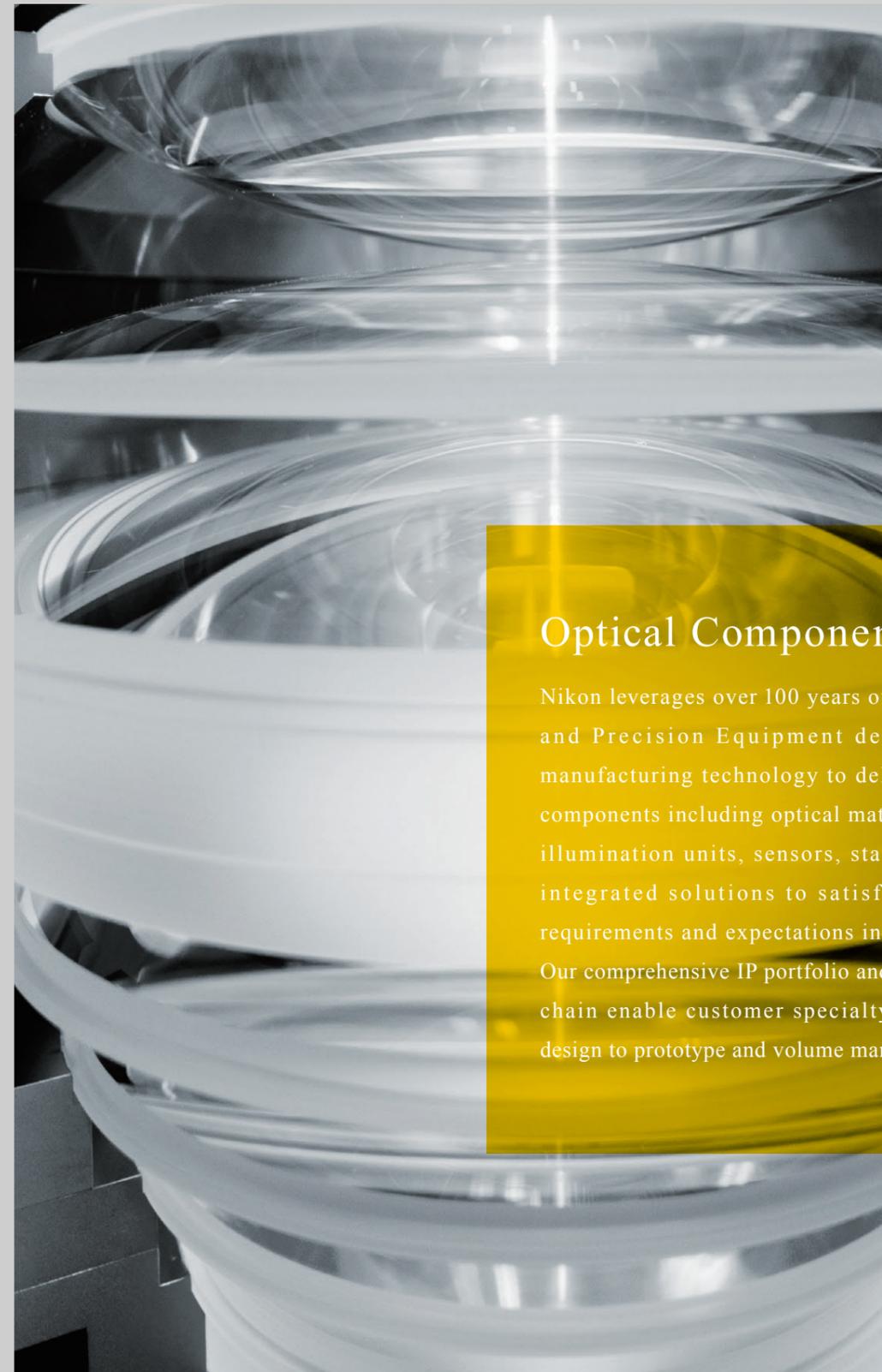
Representative value of the light transmittance at i-line (365 nm) with glass of 10 mm thickness, excluding reflection losses.

Refractive index:

Representative value of the refractive index at i-line (365 nm). Depending on the required quality, longer annealing time would be required and the refractive index value would change. The data presented are based on Nikon standard annealing condition.

Single lot variation  $n_i$ :

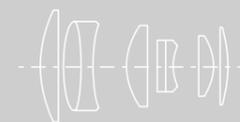
Refractive index variation of a part within a single lot, with the same melt and same annealing condition.



## Optical Components

Nikon leverages over 100 years of Optical System, and Precision Equipment development and manufacturing technology to deliver world-class components including optical materials and lenses, illumination units, sensors, stage modules, and integrated solutions to satisfy our customer requirements and expectations in various markets. Our comprehensive IP portfolio and extensive supply chain enable customer specialty programs from design to prototype and volume manufacturing.

e.g.



1. Optical Design



2. Optical Materials  
 Synthetic Silica, Calcium Fluoride,  
 i-line glass, etc.



3. Processing  
 Grinding, Polishing, Coating



4. Optical Modules  
 Projection Lens,  
 Objective Lens, etc.

N.B. Export of the products\* in this catalog are controlled under the Japanese Foreign Exchange and Foreign Trade Law. Appropriate export procedure shall be required in case of export from Japan.

\*Products: Hardware and its technical information (including software)



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