



# OPTICAL MATERIALS

# Synthetic Silica Glass

[NIFS Series]

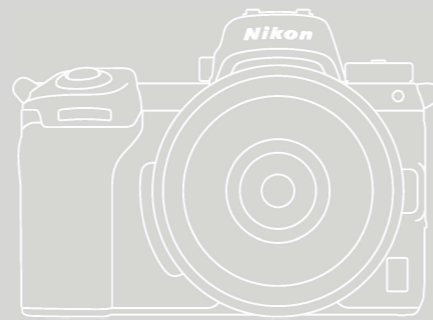


Silica glass stands out among optical materials that offer various properties and capabilities. It provides the highest standards of purity, homogeneity, and laser durability. Nikon Synthetic Silica Glass (SiO<sub>2</sub>), NIFS series, features high refractive index homogeneity, high transmittance, 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.

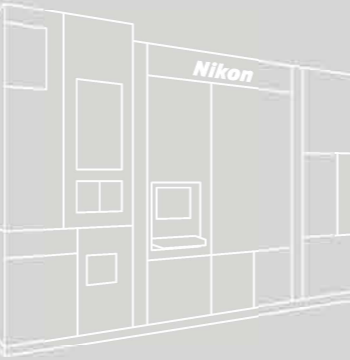
Nikon optics are used in various fields. Nikon optics are not limited to our own cameras and lithography systems. It is also used in various fields such as 3D Printers, Optical Systems, Interferometers, Laser Processing Machines, and so on.



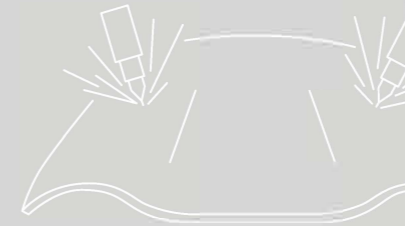
Image Measuring System



Camera



Semiconductor Lithography System



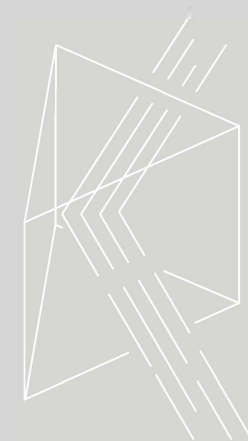
Laser Processing Machine



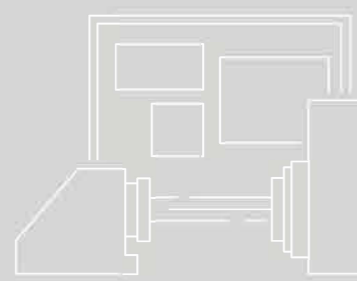
# Calcium Fluoride

[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.

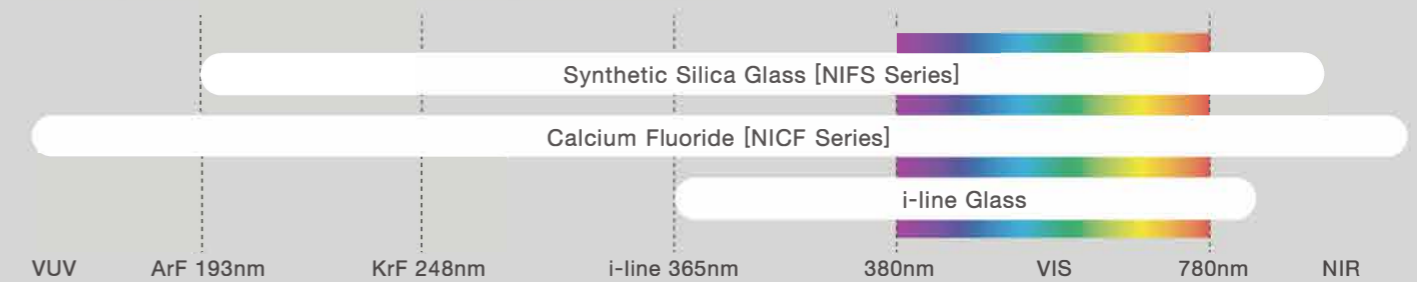


3D Printer



FPD Lithography System

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 [%]<br>Sample thickness: 10 mm | Birefringence            | Striae   | Recommended Wavelength    |
|--------|-------------------------------------------------------|--------------------------|----------|---------------------------|
| NIFS-V | 99.9 (at 193 nm)                                      | 1~10 nm/cm<br>on request | 3D       | ArF (193 nm)              |
| NIFS-A | 99.9 (at 193 nm)                                      |                          | 3D<br>1D | ArF (193 nm)              |
| NIFS-U | 99.9 (at 248 nm)                                      |                          | 3D<br>1D | KrF (248 nm)              |
| NIFS-S | 99.9 (at 365 nm)                                      |                          | 3D<br>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 [%]<br>Sample thickness: 10 mm | Birefringence            | Recommended Wavelength               |
|--------|-------------------------------------------------------|--------------------------|--------------------------------------|
| NICF-V | ≥99.5 (at 157 nm)                                     | 2~20 nm/cm<br>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:

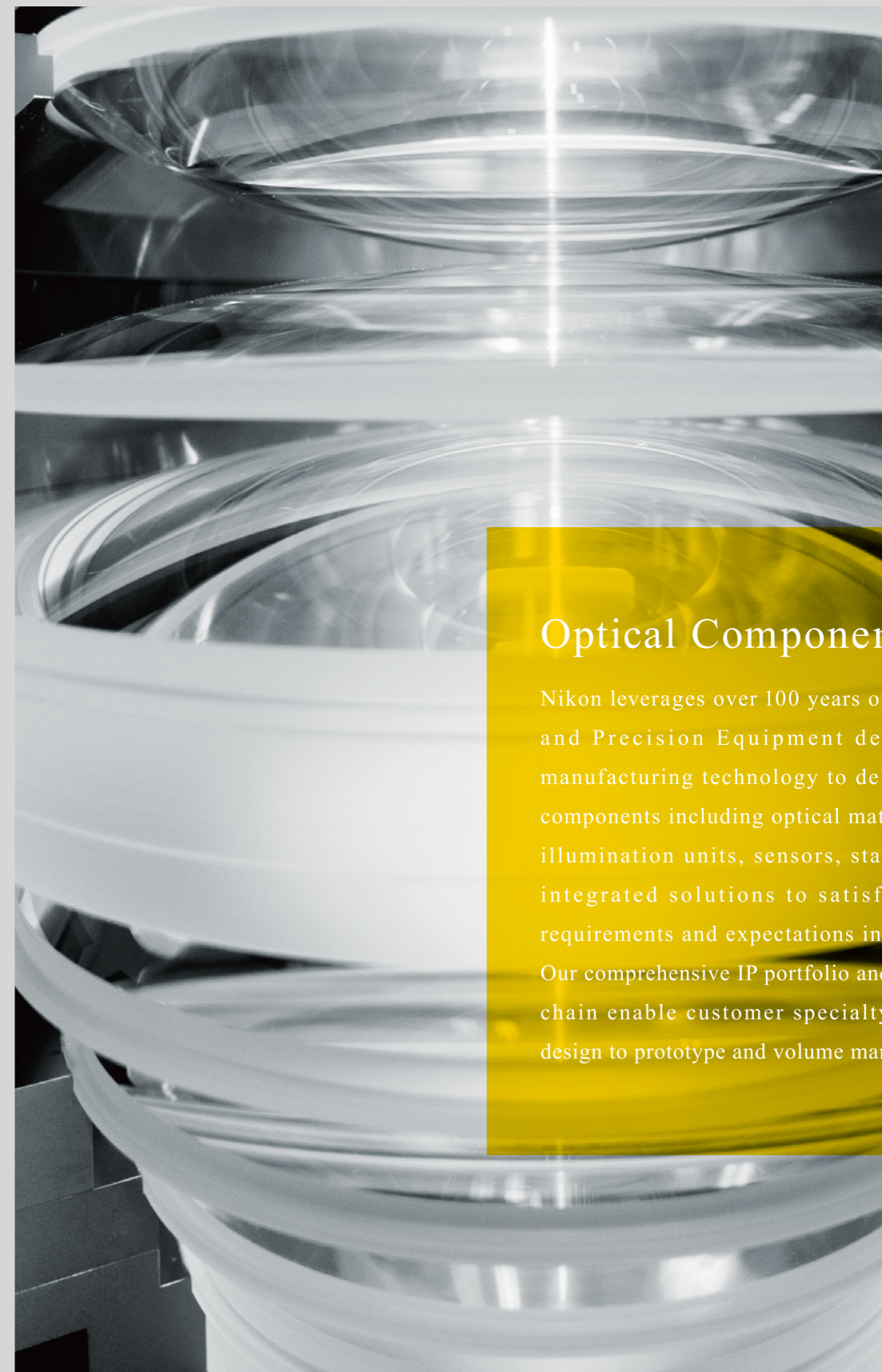
Representative value of the light transmittance at i-line (365 nm) with glass of 10 mm thickness, excluding reflection losses.

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  $n_i$ :

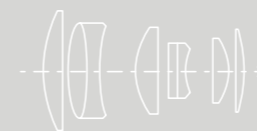
Refractive index variation of a part within a single lot, with the same melt and same annealing condition.



## 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)



**NIKON CORPORATION**  
**Digital Solutions Business Unit**

Shinagawa Intercity Tower C, 2-15-3, Konan, Minato-ku, Tokyo 108-6290, Japan  
Tel: +81-3-6433-3978 Fax: +81-3-6433-3763  
<https://www.nikon.com/products/components>