

Calcium fluoride and its excellent optical properties

- Broad wavelength range, high transmittance and low dispersion

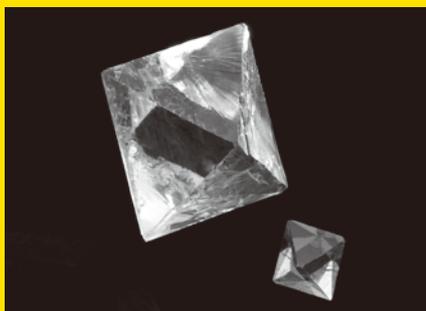
“Fluorite,” a material (crystal) that is mainly composed of calcium fluoride (CaF₂), has been known for a long time. As the name suggests, calcium fluoride produces fluorescence under ultraviolet light, as it contains a small amount of rare-earth elements. In ancient Egypt, it was used in jewelry and carvings, and also used as a flux for iron making, as it is heat-soluble. Calcium fluoride has excellent optical properties. However, natural minerals have impurities and size problems, so all calcium fluoride for industrial use is produced artificially.

Calcium fluoride can be divided into two quality types. One is used for telephotographic camera lenses. Calcium fluoride has excellent properties with high transmittance in a wide wavelength range, from infrared to ultraviolet, and extremely low dispersion (difference in refractive index). Therefore, it can minimize chromatic aberration in combination with normal optical glass. Furthermore, as the density of calcium fluoride is less than that of optical glass, it helps to make the lens itself light and compact.

The other type, of the highest quality and durability, is used in lenses for semiconductor lithography systems. Short-wavelength light sources are used in accordance with the miniaturization of semiconductor patterns. Calcium fluoride is the best lens material due to its excellent transmittance property in the vacuum ultraviolet region.



Semiconductor lithography systems have been described as the most precise machines ever made



Single calcium fluoride crystal

- Leading supplier of calcium fluoride

Nikon is a leading supplier of large-sized, high-quality single calcium fluoride crystals. The impurity density is reduced to the utmost by selecting and controlling ultra-pure materials, and optimizing the process of growing crystals. We have achieved excellent refractive index homogeneity and are able to grow high-quality, large-sized single calcium fluoride crystals.

Nikon’s calcium fluoride “NICF series” has been developed over many years for various applications, including semiconductor lithography systems, that require high levels of accuracy and durability. By leveraging our expertise in having developed and manufactured semiconductor lithography systems, we can meet customer’s needs, delivery times and cost expectations.

Nikon also provides calcium fluoride optimized for applications in the visible and infrared regions. This calcium fluoride can be used for various applications, such as digital cameras, video cameras, astronomical telescopes and optical measurement equipment.

Terminology

【Chromatic aberration】 Color distortion occurs when the light passing through a lens does not focus on one area due to the refraction index differences of each wavelength. There are two kinds of chromatic aberration. One, known as axial chromatic aberration, misaligns the image location. The other, known as chromatic difference of magnification, occurs at the periphery of the image.

【Laser durability】 Transmittance in an optical lens can weaken due to cloudiness and minor cracks caused through long exposure to powerful lasers. Lens materials for semiconductor lithography systems with powerful lasers require high laser durability.

TOPICS

We look forward to seeing you at our booth at the exhibitions.

OPIE'15 LENS EXPO

Date: April 22-24 (Wed.-Fri.), 2015

Venue: PACIFICO YOKOHAMA (Kanagawa Pref.)

LASER World of PHOTONICS

Date: June 22-25 (Mon.-Thur.), 2015

Venue: MESSE MUNCHEN (Germany)