

Revolutionizing Next-Generation AR/VR Optical Devices
A UV-Curable Nanoimprint Resin with Superior Light Resistance and High Refractive Index
— Achieving High-Precision Replication of Complex Microstructures to Enhance the Performance
and Reliability of Optical Device —

Sanyo Chemical Industries, Ltd. proudly introduces HILUCIS, a cutting-edge UV-curable nanoimprint resin designed to support the advancement of next-generation AR (Augmented Reality) and VR (Virtual Reality) optical devices. This innovative material offers exceptional transparency in the visible light spectrum, high nanoimprint compatibility*¹, and a remarkable balance of superior light resistance and high refractive index ($n_d = 1.9$).

Developed through the integration of a proprietary inorganic filler and Sanyo Chemical's expertise in UV-curable resins for display applications, HILUCIS enhances optical device design flexibility, improving viewing angles, light control, and reliability.

[Background of Development]

Nanoimprint technology enables the precise transfer of nanoscale patterns onto resin substrates, playing a vital role in manufacturing optical devices such as displays, smartphone cameras, AR/VR glasses, facial recognition systems, and autonomous driving sensors. These devices require advanced optical components—like waveguides and diffraction gratings—for light propagation, focusing, and diffraction.

Both glass and resin are commonly used materials for these optical components. Among them, UV-curable resins with high refractive indices have gained attention for their ability to expand viewing angles and improve light control performance while offering greater design flexibility and production efficiency. Common fillers used in high-refractive-index resins include titanium oxide and zirconium oxide. Titanium oxide, while exhibiting high optical activity, can cause photodegradation due to its photocatalytic properties under UV light, potentially compromising the resin's durability. On the other hand, zirconium oxide has a lower refractive index compared to titanium oxide, making it challenging to achieve a refractive index above 1.8 while maintaining sufficient light resistance.

[Technical Breakthrough]

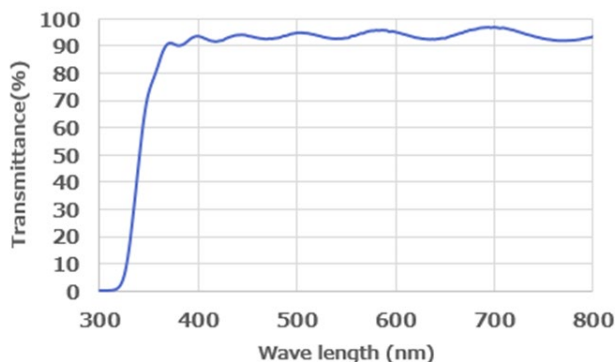
HILUCIS addresses these challenges by incorporating a proprietary inorganic filler with low optical activity, minimizing yellowing in the near-UV to visible light spectrum. Leveraging Sanyo Chemical's extensive expertise in designing UV-curable resins for display applications, the resin matrix has been carefully optimized, and HILUCIS achieves a high level of transparency, exceptional light resistance, and superior nanoimprint compatibility, successfully balancing these properties with a high refractive index.

1. Key Features of HILUCIS**1) Superior Optical Performance (Transparency and Refractive Index)**

—Enhances Design Flexibility and Improves Optical Device Performance

- **High transparency:** Achieves $\geq 90\%$ light transmittance (film thickness: 2 μm) across the visible spectrum (400–800 nm) with low haze ($\leq 0.1\%$)
- **High refractive index ($n_d = 1.9$):** Enables thinner, lighter optical devices with wider viewing angles and improved resolution.

•Light Transmittance



2) High Light Resistance

—Contributes to Enhanced Reliability of Optical Devices

- Maintains transparency with minimal yellowing after exposure to UV radiation.
- Ensures vivid, long-lasting optical performance.

•Appearance After Light Resistance



HILUCIS

Conventional high refractive index resin (Reference model)

In contrast to the conventional material created by Sanyo Chemical as a reference model, which exhibits yellowing after light exposure, the developed product maintains its initial transparency.

<Test Conditions>

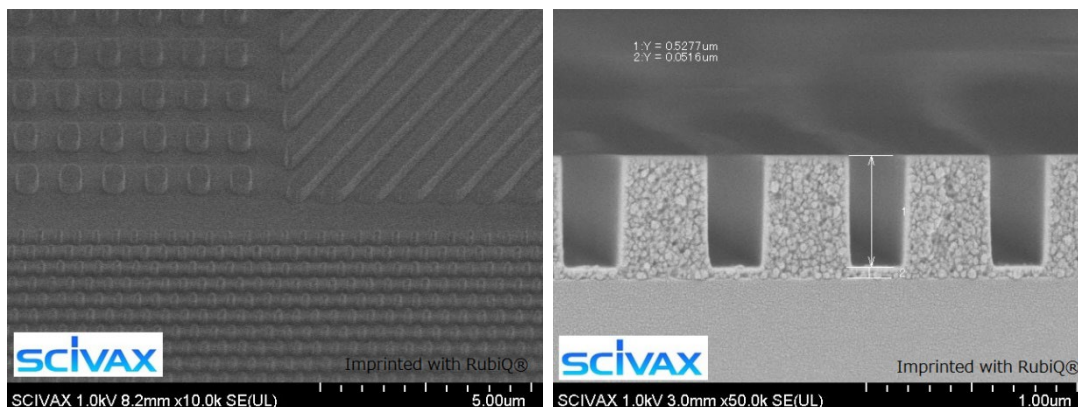
Metal halide lamp at 25 mW/cm² for 15 hours of exposure.

3) Exceptional Nanoimprint Compatibility

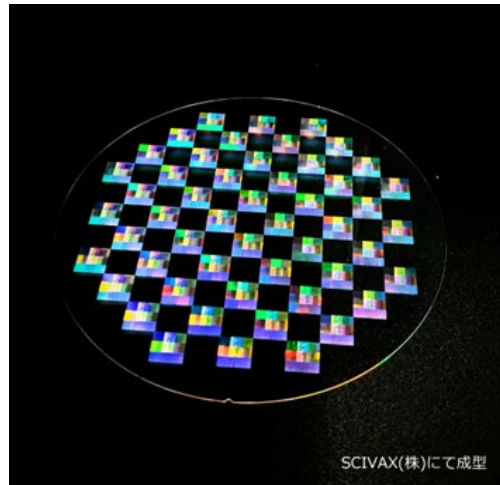
—Contributes to Enhanced Performance and Yield of Optical Devices

- Accurately replicates intricate patterns, even with significant density variations where areas of high and low density coexist on a single substrate.
- Produces thin, uniform residual films*2, enhancing optical system design flexibility.

•Example of Nanoimprint



- Nanoimprinted Wafer



2. Applications

HILUCIS is ideal for:

- Smart glasses and head-mounted displays for AR, VR, and MR (Mixed Reality).
- Sensors for autonomous driving (e.g., LiDAR, 3D sensors) and facial recognition systems.
- Micro-lens arrays and diffractive optical elements (DOEs).

[Future Plan]

As the demand for realistic and immersive AR/VR displays, enhanced wearing comfort, and increased sensitivity in autonomous driving sensors grows, optical devices require further improvements in performance and reliability. Sanyo Chemical aims to apply HILUCIS to these next-generation optical devices, contributing to ongoing technological innovation.

< Upcoming Exhibitions >

Visit us to learn more about HILUCIS:

- 1) CONVERTECH & New Functional Materials Expo & GREEN MATERIAL & 3DECOTECH & WELL-BEING TECHNOLOGY
(January 29–31, 2025, Tokyo Big Sight)
- 2) SPIE (AR | VR | MR)
(January 27–29, 2025; Exhibition dates: January 28–29, showcasing our developed products, San Francisco, USA)

< Term Explanation >

*1 Nanoimprint compatibility refers to the material's ability to achieve high-precision replication of nanoscale patterns.

*2 Residual film: Refers to the thin layer of resin that remains on the substrate after the nanoimprint process. If the residual film is too thick or uneven, it can cause light to be absorbed or scattered within these layers, potentially reducing brightness.



About Sanyo Chemical

Sanyo Chemical established in 1949 in Kyoto, Japan, is a global manufacturer and seller of performance chemicals. Beginning as a manufacturer of soap and texture agents we have since diversified our product portfolio to meet the needs of the market, Today, we feature over 3,000 diverse types of products and have established an international presence. Our portfolio of chemicals spans a variety of industries and types, from automotive components to daily-use electronics, as well as cosmetics and medical equipment, all with the aim of creating safe and environmentally friendlier offerings, improving lives and societies across the world. We aim to contribute to realize a sustainable society through our corporate activities

<https://www.sanyo-chemical.co.jp/eng>

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