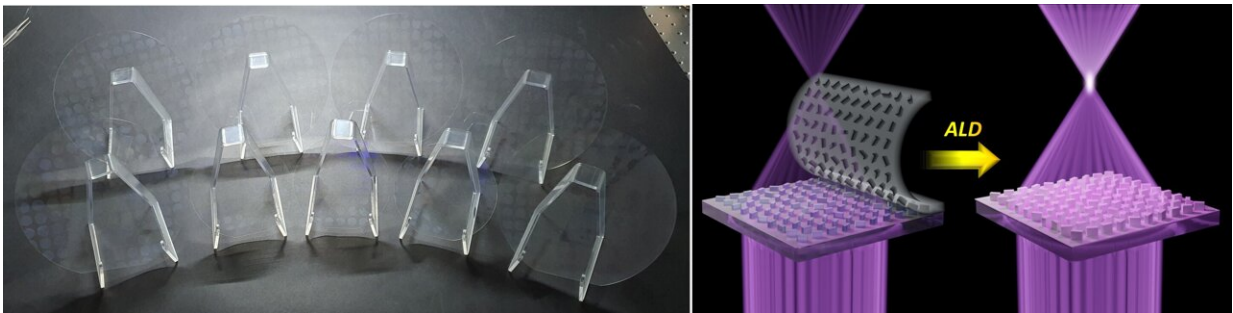


Team achieves successful mass production of metalenses designed for application in the ultraviolet region

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Mass-produced UV metalenses. Credit: POSTECH

Ultraviolet rays find diverse applications in medical and health care, serving purposes such as disinfection, sterilization, and therapy. They are also used in the semiconductor industry for creating microcircuits and patterns.

A metalens fabrication process, developed by a team of researchers at Pohang University of Science and Technology (POSTECH), enables control over the optical properties of these UV rays. This innovation has garnered significant attention across industries, sparking interest in potential advancements.

A collaborative research team, comprising Professor Junsuk Rho from the Department of Mechanical Engineering and the Department of Chemical Engineering and others, has devised a technique for the mass production of large-area metalenses tailored for use in the ultraviolet region. The findings of their research have been [published](#) in *Materials Today*.

Metalenses control light properties through nanometer-scale patterns or structures on lens surfaces. With the ability to reduce the thickness of conventional lenses by a factor of 10,000, they hold significant promise in [medical devices](#) that are inserted in the body and wearable devices. Ongoing active research aims to achieve mass production and commercialization of metalenses.

However, ultraviolet light poses challenges as it is absorbed by most materials due to its high energy level. The shorter wavelength of ultraviolet light requires more structures for the same area. Furthermore, unlike visible and infrared light, the limited availability of materials transparent to ultraviolet light complicates the production of large-area metalenses. Additionally, nanoprocessing technology constraints have resulted in most reported metalenses for [ultraviolet light](#) being smaller than 500 μm (micrometers).

In prior research endeavors, the team collaborated with Dr. Gyoseon Jeon's team at the Research Institute of Industrial Science and Technology (RIST) to achieve successful mass production of metalenses for visible light as published in *Nature Materials*, and for [infrared light](#) as recently reported in *Laser and Photonics Reviews*.

The researchers extended their process by incorporating a zirconium oxide (ZrO_2) material, transparent in the ultraviolet region, enabling the [mass production](#) of a metalense measuring 1 centimeter (cm) on a wafer. Employing a nano-imprinting process that engraves the pattern like a

stamp, the team achieved the rapid and inexpensive production of metalenses that are 20,000 times larger than conventional ones.

Professor Junsuk Rho who led the research said, "This marks the first instance of implementing a metalens with exceptional light-modulation capabilities over a large area in the ultraviolet region. We are committed to continually improving the technology for potential applications in industrial sectors such as semiconductor inspection equipment through further research efforts."

More information: Joohoon Kim et al, 8" wafer-scale, centimeter-sized, high-efficiency metalenses in the ultraviolet, *Materials Today* (2024). [DOI: 10.1016/j.mattod.2024.01.010](https://doi.org/10.1016/j.mattod.2024.01.010)

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