NGK INSULATORS, LTD.

SINCE 1919 99 YEARS

October 15, 2018
NGK INSULATORS, LTD.

NGK Develops Micro-lens with Cavity for UV LEDs

Realizes Greater Light Extraction Efficiency and Lower Costs in UV LEDs

NGK INSULATORS, LTD. (President Taku Oshima; Headquarters: Nagoya, Japan; "NGK") today announced that it has applied its proprietary technologies to successfully develop a Quartz glass Micro-lens equipped with a Cavity (space) to arrange ultra-violet (UV) light-emitting diode (LED) chips.

Mercury lamps are currently popularly used as the UV light sources for sterilizing water and air. Against the backdrop of the Minamata Convention on Mercury, which went into effect in August 2017, there is a possibility that use of mercury lamps may be banned in the future. This has raised interest in UV LEDs, which do not use mercury, and the UV LED market is forecast to grow to about U.S. $400 million by 2021*1.

In conventional UV LEDs, LED chips are arranged in an expensive, box-shaped ceramic package that absorbs some of the UV rays in its side wall, lowering the LED output and making it more difficult to cut costs. However, when using NGK's Micro-lens equipped with a cavity to arrange LED chips, a cheap, flat ceramic substrate can be used, thus eliminating absorption of UV rays in the ceramic package, enhancing light extraction efficiency*2 and increasing LED output. This also makes it possible to cut UV LED costs.

NGK's proprietary technologies make it possible to create cavities in any shape, such as a dome. This reduces UV irradiation in the bonded surface between the ceramic substrate and Micro-lens. Currently, Micro-lenses are bonded to the box-shaped ceramic package with high-priced metal that is resistant to UV rays to ensure reliability, but using NGK's Micro-lens for UV LEDs raises the reliability of cheaper resin bonding, making resin bonding feasible and further reducing costs. Moreover, since lenses and not just cavities can be made with a high degree of precision in response to requirements, combining various lenses and cavity shapes creates more efficient light extraction and enables control of light distribution angle*3, which contributes to greater performance in devices equipped with UV LEDs.

As a result of customers' sample evaluations, the customers decided to use NGK's Micro-lens for their UV LEDs. NGK is now preparing to move forward with mass production. NGK is also considering applying NGK's proprietary technologies that make it possible to create transparent quartz glass components in complex 3-D shapes such as lens arrays with high precision in applications other than UV LEDs.

*1 Source: Yole Développement, UV-LED 2018 Report

*2 Light extraction efficiency: The ratio of output power emitted outside from an LED package against output power emitted directly from an LED chip

*3 Light distribution angles: The angle at which light spreads

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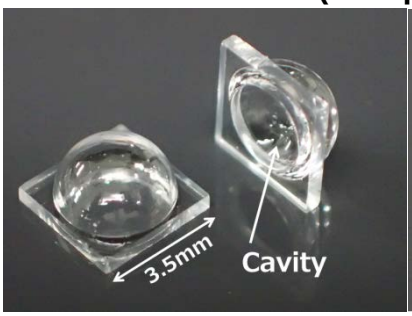
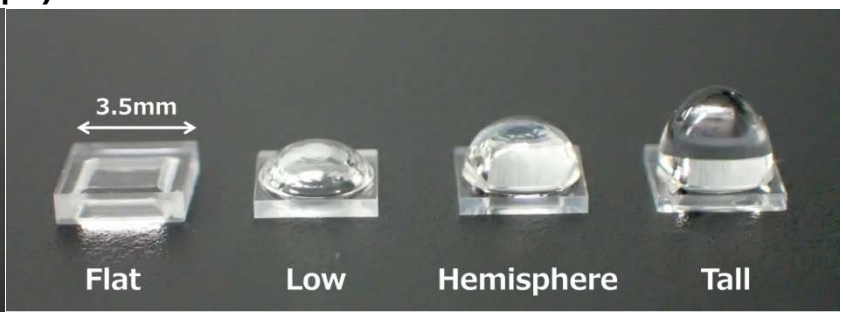
Micro-lens for UV LED (example)

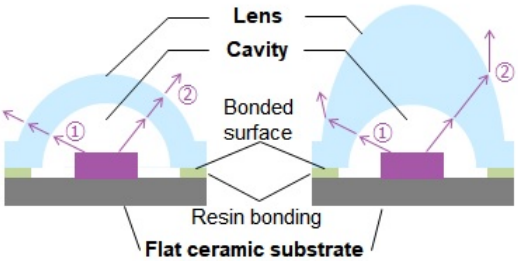
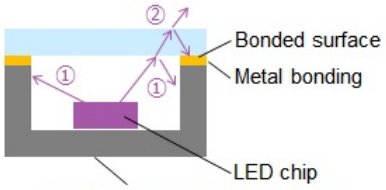


Dome-shaped cavity



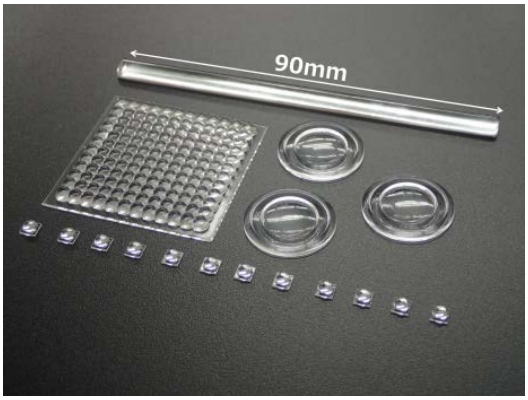
Various types of lens shapes

Comparison between NGK Products and Conventional Products

		NGK product (example)	Conventional product
	Package image and light distribution angle*	■ No light concentration : 130° ■ With light concentration : 25° 	■ No light concentration : 108° 
①	**Light extraction efficiency***	**93%** No light absorption in package	**75%** UV rays absorbed in side wall of ceramic package
②	**UV illuminance to bonded surface*** Using conventional products as a base of 100	**< 10** Lower UV irradiation to bonded surface → Enhancing reliability of resin bonding	**100** Heavy UV irradiation to bonded surface → Require expensive metal bonding

* Results of NGK simulation

Transparent quartz glass components of various shapes



Supported sizes (current)

Outer diameter: Max. 100 mm

Thickness: Max. 5 mm