Sticker makes nanoscale light manipulation easier to manufacture

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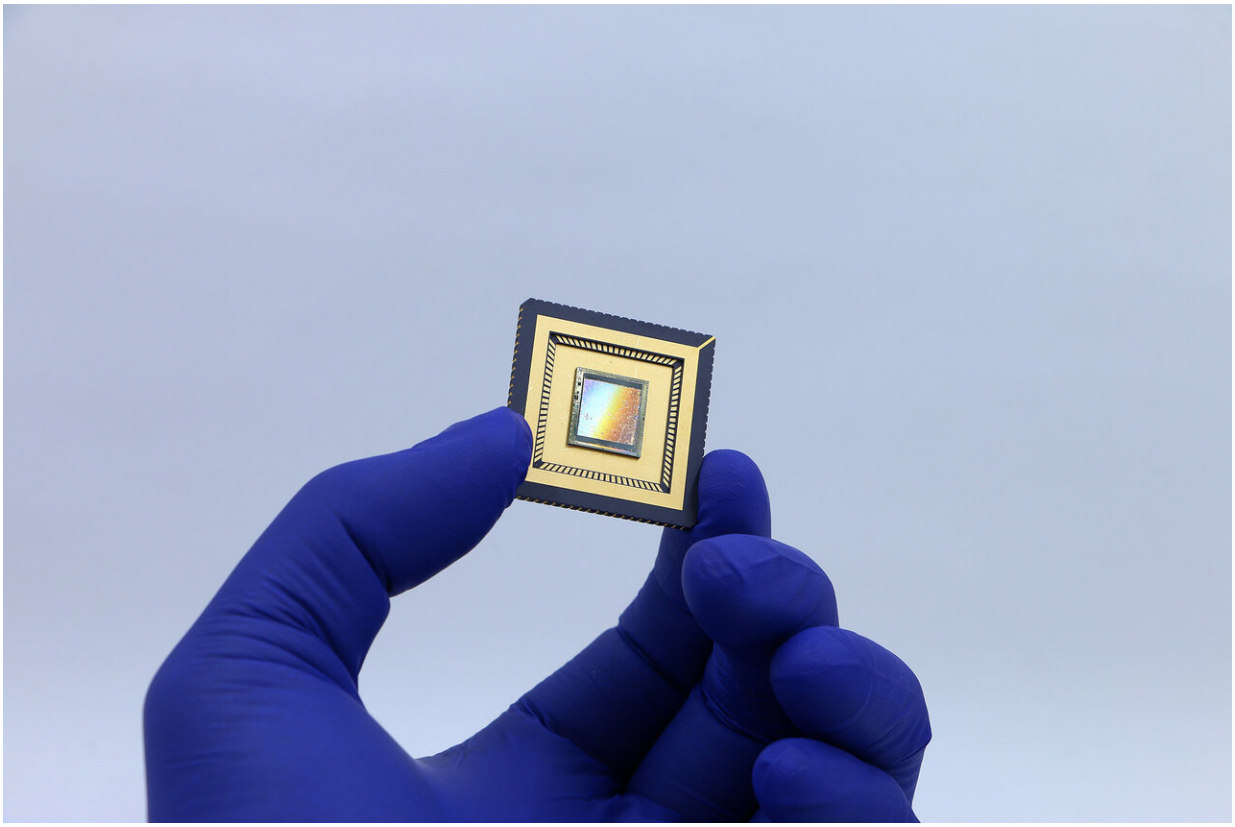

Researchers have given sensors the ability to manipulate light better, thanks to a sticker in the center of this device. Credit: Purdue University image/Bongjoong Kim

Human pathogens, such as HIV and viruses causing respiratory tract

infection, have molecular fingerprints that are difficult to distinguish. To better detect these pathogens, sensors in diagnostic tools need to manipulate light on a nanoscale.

But there isn't a good way to manufacture these light manipulation devices without damaging the sensors. Purdue University engineers have a solution: Stickers.

In a paper published in *Nano Letters*, the team integrated light manipulation devices called 3-D plasmonic nanoarrays onto peelable films that can stick to any surface. They tested the sticker nanoarray's capabilities on the lenses of sensors, which make up conventional imaging systems.

The Air Force Research Laboratory supported the work and validated the sticker's performance and properties.

"Unlike any existing approaches, the entire process occurs in distilled water at room temperature without the chemical, thermal or mechanical treatments that can damage sensitive surfaces, such as a sensor lens," said Chi Hwan Lee, an assistant professor of biomedical engineering and mechanical engineering at Purdue.

To turn the nanoarrays into a sticker, the researchers built them into a film on a silicon wafer. When submerged in distilled water, the film peels cleanly from the wafer, allowing the wafer to be reused. The film can then stick to the desired surface without damaging it.

"Because this methodology allows 3-D plasmonic nanoarrays to physically separate from a donor wafer and transfer over to another surface without defect, it offers a major cost- and time-saving factor in the manufacturing scheme," Lee said.

The researchers also demonstrated that the process works for various classes of 3-D plasmonic nanoarrays in both lateral and vertical configurations, offering more functionality.

Lee's lab plans to further develop these sticker nanoarrays for biological sensing applications, such as for protein detection in clinical diagnostics. The lab has already created electronic stickers that serve as bio-patches for drug delivery. They also can enable ordinary objects to wirelessly connect to a network, creating an Internet of Things.

More information: Bongjoong Kim et al. Deterministic Nanoassembly of Quasi-Three-Dimensional Plasmonic Nanoarrays with Arbitrary Substrate Materials and Structures, *Nano Letters* (2019). DOI: 10.1021/acs.nanolett.9b02598

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