New technology to fabricate high-performance, flexible optical devices

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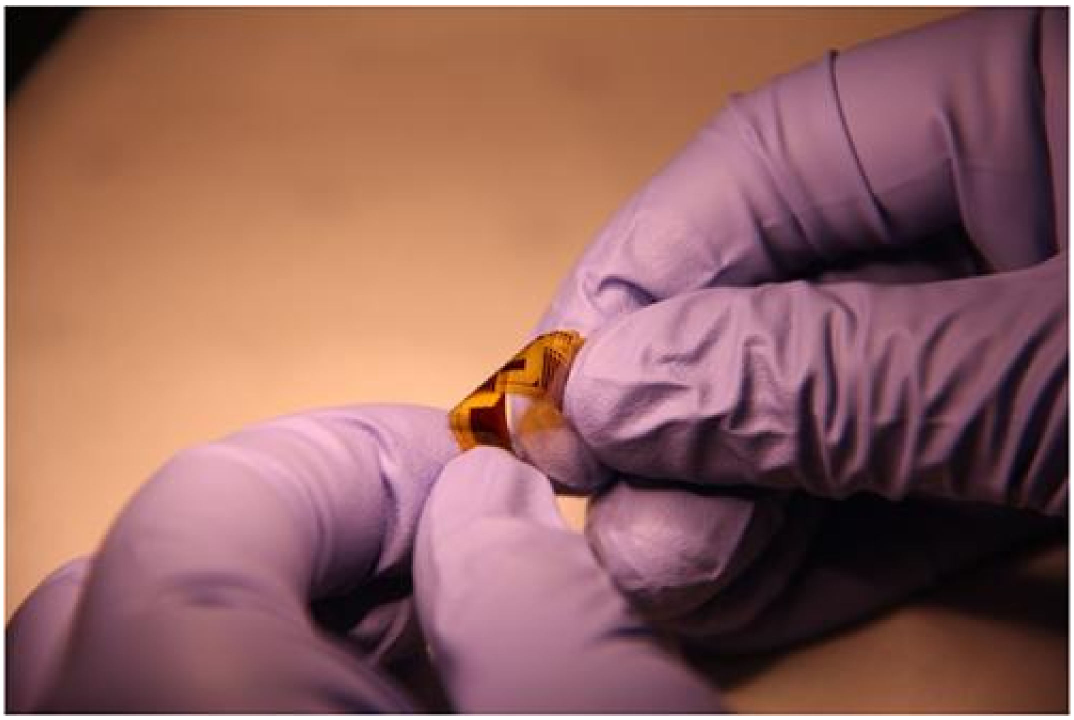

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Chalcogenide glass is a material commonly used in infrared optics, optical fibers, camera lenses and prisms. While the material is not flexible, it is fully compatible with polymers, which are flexible, allowing it to be processed and made into devices.

"The beauty of this technology is that the chalcogenide glass works with almost any type of polymer, allowing it to be used in many ways," explains Juejun Hu, assistant professor of materials science and engineering and lead researcher on the project.

Working with colleagues at University of Texas, Austin, and University of Central Florida, Hu's team developed an innovative design to exploit the fact that polymers naturally tend to deform (or bend) in certain ways, with some areas remaining rigid all the time.

By selectively placing the photonic device, comprised of chalcogenide glass, in the areas of the polymer that will not deform when bent, twisted or rolled, Hu is able to achieve a device with superior flexibility and high optical performance.

"Simply put, our design allows us to make the rigid material do something very flexible," he said.

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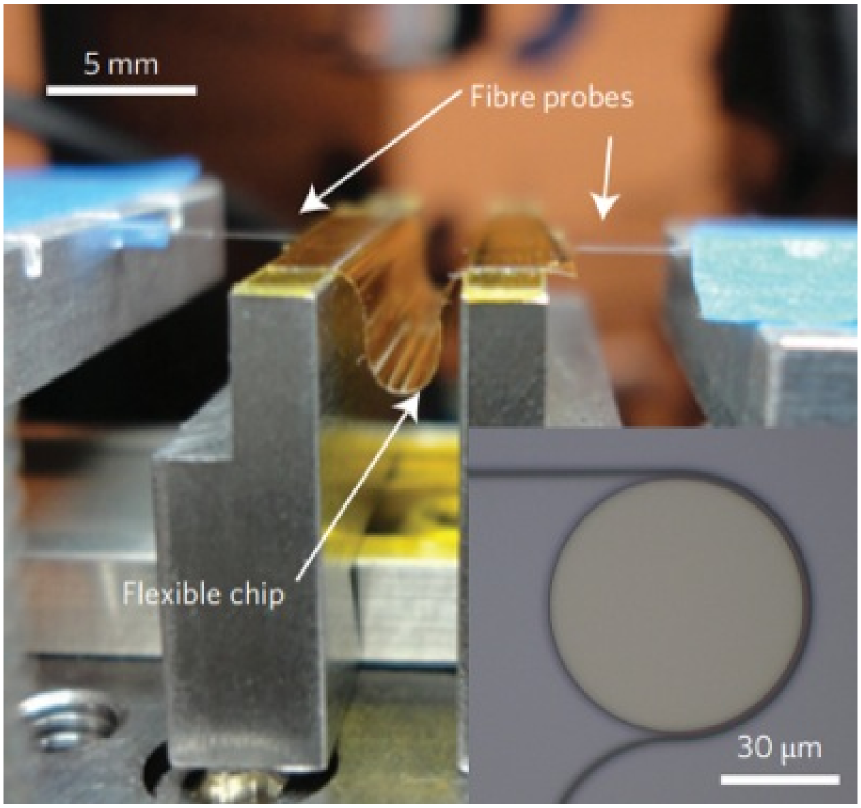

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In laboratory testing Hu's device functioned well, even when bent to a radius of one-half millimeter over 5,000 times. The device experienced one of the lowest optical loss on record, almost an order of magnitude less than previous flexible optical devices.

Applications for the work include wearable devices, flexible consumer electronics and foldable portable power generation systems, even sensors that can be integrated on human skin.

For photonics applications, Hu's device can provide better power efficiency and sensitivity, while making it an attractive option for small photonic devices with cramped or unusually shaped spaces.

It also opens the door for photonics to be used in biomedical applications such as flexible electrodes to measure the electrical activity of the brain during an electroencephalogram (EEG).

More information: "Integrated flexible chalcogenide glass photonic devices." Lan Li, Hongtao Lin, Shutao Qiao, Yi Zou, Sylvain Danto, Kathleen Richardson, J. David Musgraves, Nanshu Lu & Juejun Hu. *Nature Photonics* 8, 643–649 (2014) DOI: 10.1038/nphoton.2014.138. Received 26 July 2013 Accepted 27 May 2014 Published online 29 June 2014

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