Graphene photonics breakthrough promises fast-speed, low-cost communications

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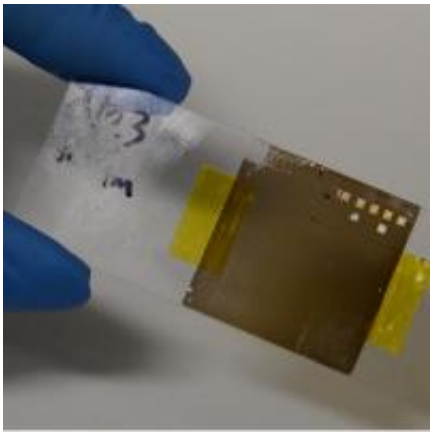

(Phys.org) —Swinburne researchers have developed a high-quality continuous graphene oxide thin film that shows potential for ultrafast telecommunications.

Associate Professor Baohua Jia led a team of researchers from Swinburne's Centre for Micro-Photonics to create a micrometre thin film with record-breaking optical nonlinearity suitable for high performance integrated photonic devices used in all-optical communications, biomedicine and photonic computing.

"Such a laser patternable highly nonlinear thin film, about one hundredth of a human hair, has not been achieved by any other material," Professor

Jia said.

Graphene is derived from carbon, the fourth most abundant element on earth. It has many useful properties, including light transparency and electrical conductivity, and can be completely recycled.

To create the thin film the researchers spin coated graphene oxide solution to a glass surface.

Using a laser as a pen they created microstructures on the graphene oxide film to tune the nonlinearity of the material.

"We have developed a new platform in which we can fabricate each optical component with desired nonlinearity," PhD student Xiaorui Zheng said.

"Currently with telecommunications or all optical communications you have to fabricate each component individually and try to integrate them together.

"Now we can provide a film, on which everything can be fabricated with laser and then it is automatically integratable."

Current manufacturing methods in semiconductor labs require expensive cleanrooms to fabricate photonic chips. The fabrication and laser writing of this photonic material is simple and low cost.

"Using this new method, we have demonstrated the possibility of manufacturing a scalable and cheap material," Professor Jia said.

The research is published in *Advanced Materials*.

The researchers are now working to fabricate a functional device.

More information: Zheng, X., Jia, B., Chen, X. and Gu, M. (2014)," In Situ Third-Order Non-linear Responses During Laser Reduction of Graphene Oxide Thin Films Towards On-Chip Non-linear Photonic Devices." *Adv. Mater.*, 26: 2699–2703. doi: 10.1002/adma.201304681

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