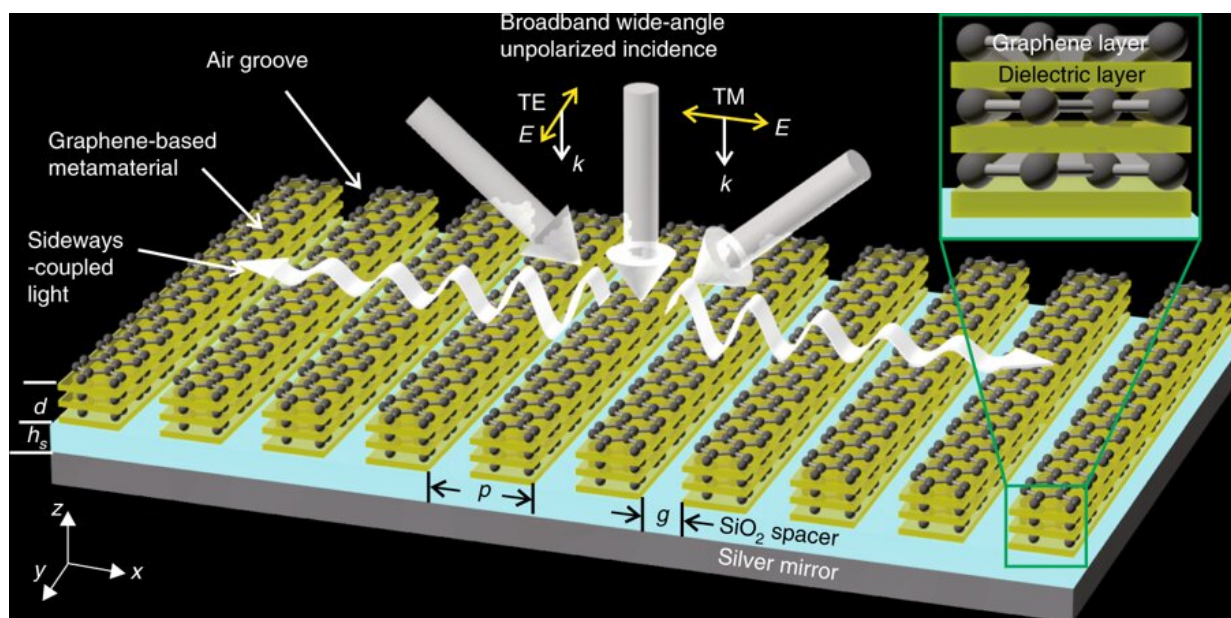


Novel form of graphene-based optical material developed

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Schematic of graphene-based metamaterial absorber. Credit: *Nature Photonics*

Researchers at the University of Sydney, Swinburne University of Technology and the Australian National University have collaborated to develop a solar absorbing, ultrathin film with unique properties that has great potential for use in solar thermal energy harvesting.

The 90-nanometre material is 1000 times finer than a [human hair](#) and can be rapidly heated up to 160 degrees under natural sunlight in an open

environment.

This new graphene-based material also opens new avenues in:

- thermophotovoltaics (the direct conversion of heat to electricity)
- solar seawater desalination
- infrared light source and heater
- optical components: modulators and interconnects for communication devices
- photodetectors

It could even lead to the development of invisible cloaking technology via large-scale thin films enclosing the objects to be hidden.

Professor Martijn De Sterke from the University of Sydney Nano Institute and School of Physics is Director of the Institute for Photonics and Optical Science. He said: "Through our collaboration, we came up with a very innovative and successful result.

"We have developed a new class of optical material, the properties of which can be tuned for multiple uses."

The researchers have developed a 2.5cm x 5cm working prototype to demonstrate the photo-thermal performance of the graphene-based metamaterial absorber.

They have also proposed a scalable manufacture strategy to fabricate the proposed graphene-based absorber at low cost.

"This is among many graphene innovations in our group," said Professor Baohua Jia, Research Leader, Nanophotonic Solar Technology, in Swinburne's Centre for Micro-Photonics.

"In this work, the reduced graphene oxide layer and grating structures were coated with a solution and fabricated by a laser nanofabrication method, which are both scalable and low cost."

"Our cost-effective and scalable graphene absorber is promising for integrated, large-scale applications, such as energy-harvesting, thermal emitters, optical interconnects, photodetectors and optical modulators," said first author of the research paper, Dr. Han Lin, Senior Research Fellow at Swinburne's Centre for Micro-Photonics.

"Fabrication on a flexible substrate and the robustness stemming from graphene make it suitable for industrial use," Dr. Keng-Te Lin, another author from Swinburne, said.

"The physical effect causing this outstanding absorption in such a [thin layer](#) is quite general and thereby opens up a lot of exciting applications," said Dr. Bjorn Sturmborg, who completed his Ph.D. in physics at the University of Sydney in 2016 and is now a lecturer at the Australian National University.

More information: Han Lin et al. A 90-nm-thick graphene metamaterial for strong and extremely broadband absorption of unpolarized light. *Nature Photonics*. March 18, 2019

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