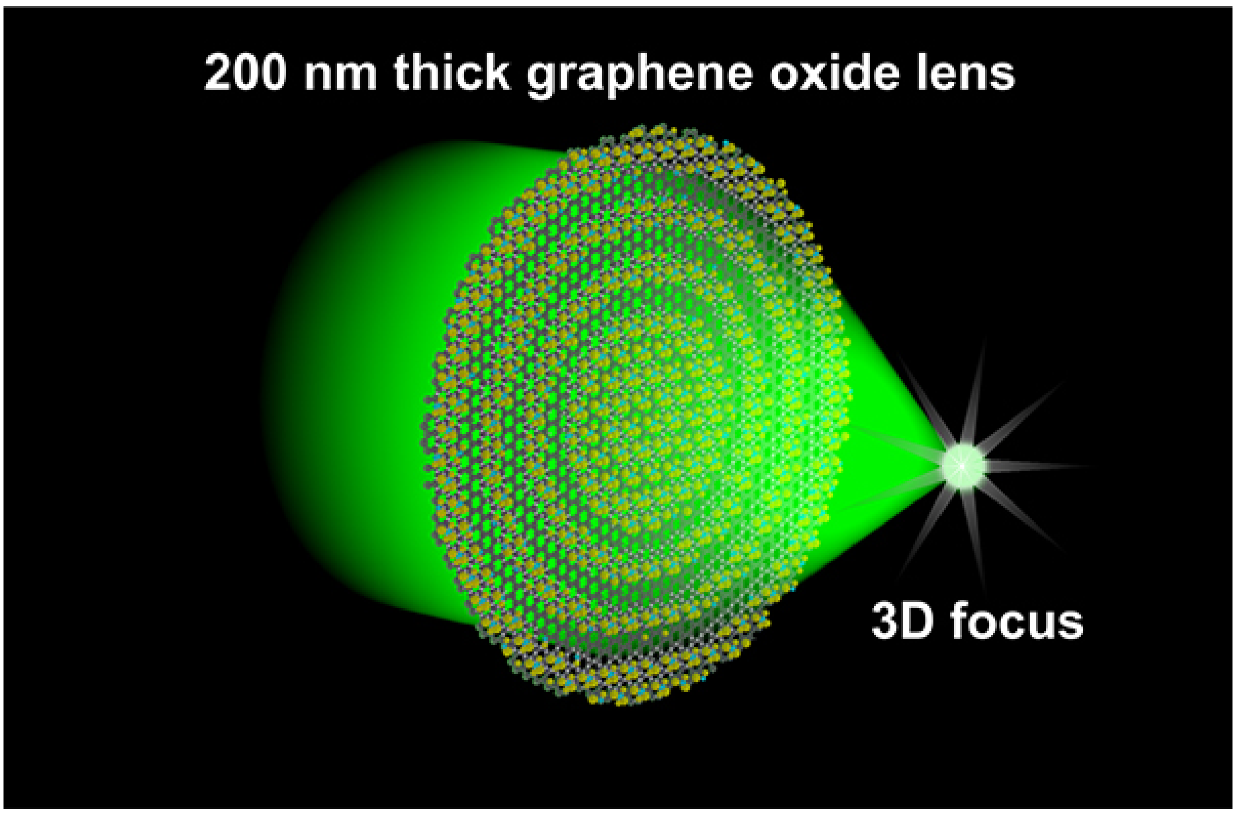
Ultrathin lens could revolutionise next-gen devices

September 23 2015, by Lea Kivivali



Researchers at Swinburne University of Technology, collaborating with Monash University, have developed an ultrathin, flat, ultra-lightweight graphene oxide optical lens with unprecedented flexibility.

The ultrathin lens enables potential applications in on-chip nanophotonics and improves the conversion process of solar cells. It also opens up new avenues in:

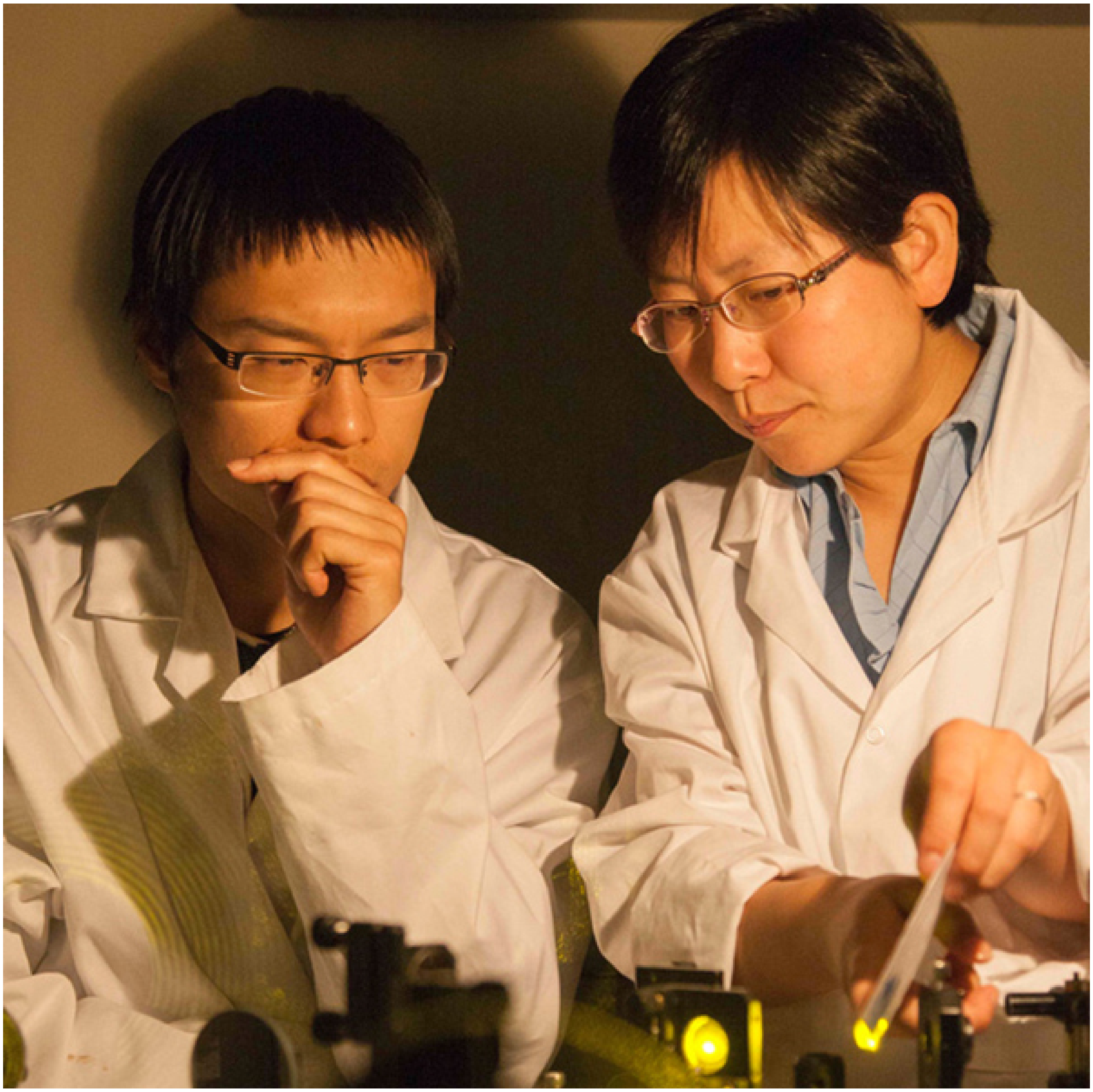
- non-invasive 3D biomedical imaging
- photonic chips
- aerospace photonics
- micromachines
- laser tweezing – the process of using lasers to trap tiny particles.

Optical lenses are indispensable components in almost all aspects of technology including imaging, sensing, communications, and medical diagnosis and treatment.

The rapid development in nano-optics and on-chip photonic systems has increased the demand for ultrathin flat lenses with three-dimensional subwavelength focusing capability – the ability to see details of an object smaller than 200 nanometres.

Recent breakthroughs in nanophotonics have led to the development of a number of ultrathin flat lens concepts, however their real-life application is limited due to their complex design, narrow operational bandwidth and time consuming manufacturing processes.

"Our lens concept has a 3D subwavelength capability that is 30 times more efficient, able to tightly focus broadband light from the visible to the near infrared, and offers a simple and low-cost manufacturing method," research leader in nanophotonics at Swinburne's Centre for Micro-Photonics (CMP), Associate Professor Baohua Jia, said.



Lead authors PhD candidate Xiaorui Zheng and Associate Professor Baohua Jia.

The researchers produced a film that is 300 times thinner than a sheet of paper by converting graphene oxide film to reduced graphene oxide through a photoreduction process.

"These flexible graphene oxide lenses are mechanically robust and maintain excellent focusing properties under high stress," lead author of the research, PhD candidate Xiaorui Zheng said. "They have the potential to revolutionise the next-generation integrated optical systems by making miniaturised and fully flexible photonics devices."

CMP Director, Professor Min Gu, said: "The newly demonstrated laser nano-patterning method in graphene oxides holds the key to fast processing and programming of high capacity information for big data sectors."

Professor Dan Li, Co-director of the Monash Centre for Atomically Thin Material, which provided the graphene oxide film for this research said this work opens up a new high-tech application for graphene oxide and demonstrates how nanotechnology can add significant value to natural graphite.

More information: "Highly efficient and ultra-broadband graphene oxide ultrathin lenses with three-dimensional subwavelength focusing." *Nature Communications* 6, Article number: 8433 DOI: 10.1038/ncomms9433

Provided by Swinburne University of Technology