Graphene Protected Plasmonics

BACKGROUND

Plasmonics represent a potentially novel route to improve data processing, photovoltaic efficiency and bio-sensing technologies. However, the technology has struggled to find traction in the commercial market due to its reliance on gold-based materials. Gold is both expensive and has the disadvantage that it diffuses into silicon rendering it unsuitable for use in commonly used silicon based platforms. Computational studies suggest that a potential alternative to gold can be found in the pairing of an alternative plasmonic metal, such as copper, with a protective 2D material like graphene. However, until now previous attempts at developing such systems have resulted in lowered plasmonic performances.

THE TECHNOLOGY

Academics at the University of Manchester have developed a novel approach to the manufacturing of plasmonics that are made from a range of metals protected by a 2D layer of graphene. The protective graphene layer prevents the plasmonic surface from oxidation and degradation, allowing the use of a wider range of plasmonic metals as well as widening the scope of potential applications of these devices.

KEY BENEFITS

- The ability to create plasmonic devices out of a range of metals, allowing an alternative to commonly used gold plasmonics which are expensive and incompatible with silicon.
- Protection of the plasmonic metal with graphene prevents corrosion during the manufacturing process.
- The protective 2D layer prevents degradation of the plasmonic metal surface in wet environments, making these plasmonic devices preferential for bio-sensing applications.

APPLICATIONS

- The development of data processing devices, which facilitate transmitting large amounts of data at rapid speeds across a microchip surface.
- Improving the energy harvesting capability of photovoltaic cells.
- The development of highly sensitive biosensors, capable of single molecule detection.
- Improving the performance of antennae as well as allowing compression in their size; characteristics that would be of interest to the communications industry.
- Incorporation into optics enabling the creation of nanoscale polarisers.
- The development of a new plasmonic based imaging technology, offering an improved resolution alternative to optical microscopes.

- In addition to this, plasmonic materials are also capable of generating hot electrons and hot ‘holes’. Using this principle, it is feasible that the technology could be used in a cancer treating capacity.

INTELLECTUAL PROPERTY

A patent application has been filed to protect this technology in a number of worldwide territories.

RELEVANT PUBLICATIONS

- Super-Narrow, Extremely High Quality Collective Plasmon Resonances at Telecom Wavelengths and Their Application in a Hybrid Graphene-Plasmonic Modulator. Benjamin D. Thackray, Philip A. Thomas, Gregory H. Auton, Francisco J. Rodriguez, Owen P. Marshall, Vasyl G. Kravets, and Alexander N. Grigorenko. DOI:10.1021/acs.nanolett.5b00930.
- Hybrid graphene plasmonic waveguide modulators. D. Ansell, I. P. Radko, Z. Han, F. J. Rodriguez, S. I. Bozhevolnyi. DOI: 10.1038/ncomms9846.
- Graphene-protected copper and silver plasmonics. V. G. Kravets, R. Jalil, Y.-J. Kim, D. Ansell, D. E. Aznakayeva, B. Thackray, L. Britnell, B. D.Belle, F. Withers, I. P. Radko, Z. Han, S. I. Bozhevolnyi, K. S. Novoselov, A. K. Geim & A. N. Grigorenko. DOI: 10.1038/srep05517.

OPPORTUNITY

The technology presents an excellent licensing and development opportunity.

CONTACT

Dr Siobhan Daniels, IP Development and Partnering Manager - Graphene, UMIP, Core Technology Facility, 46 Grafton Street, Manchester M13 9NT ✉ siobhan.daniels@umip.com
☎: + 44 (0) 161 306 8813