

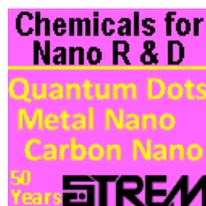
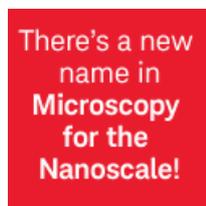
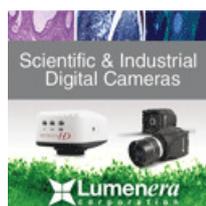


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Researchers Review Potential of Graphene and Materials in Energy Sector

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Graphene has many potential applications, among them energy conversion and storage. Graphene – a single layer of carbon atoms related two-dimensional crystals combine high electrical conductivity, physical flexibility and a huge surface to weight ratio. Such qualities make them suitable for storing electric charge in batteries and supercapacitors and as catalysts in solar and fuel-cell electrodes.

A number of energy applications for 2D crystals are under development worldwide, and Europe's Graphene Flagship has invested significant resources in this area. Now, in an article for the journal Science, flagship scientists – together with colleagues in the US and Korea – provide a wide-ranging review of the potential for graphene and related materials in the energy sector. The authors hope that their review will help guide researchers in industry and academia to identify the best routes towards successful applications that benefit society as a whole.



Francesco Bonaccorso (c) A. Abate, [Italiano di Tecnologia@IIT](#)

The researchers – led by physicist Francesco Bonaccorso, who is based at the Graphene Labs of the Italian Institute of Technology in Genova, and is a Royal Society Newton Fellow at the Cambridge Graphene Centre – report substantial progress made in material preparation at the laboratory level. They also face the challenge of producing the materials on an industrial scale in a cost-effective manner.

Graphene, the best known of the hundreds of two-dimensional crystals investigated, has a very high surface-to-mass ratio. With around 2,600 square metres for every gram, graphene is all surface and no bulk, and it is this 2D nature which gives graphene its unique electrical, thermal and mechanical properties.

In the review article, the researchers examine the progress made so far – and look at the future potential of 2D crystals in:

- Solar cells
- Thermoelectric devices
- Fuel cells
- Batteries
- Supercapacitors
- Hydrogen production and storage

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For a summary of the review's findings, see <http://bit.ly/1z7F3AQ>


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The researchers conclude that graphene and related two-dimensional crystals may play a key role in future energy conversion and storage technologies. This is an active area of development for Graphene Flagship partners, both academic and industrial.

"The huge interest in two-dimensional crystals for energy applications comes both from their unique physico-chemical properties, and the possibility of producing and processing them in large quantities, in a cost-effective manner," says Bonaccorso.

"In this context, the development of functional inks based on two-dimensional crystals may provide a gateway for the realisation of new generation electrodes in energy storage and conversion devices." Bonaccorso adds that the challenge ahead is to demonstrate a disruptive technology which two-dimensional materials not only replace traditional electrodes, but more importantly enable the design of whole new device concepts.

Review co-author Andrea Ferrari, who chairs the Executive Board of the Graphene Flagship and is director of the Cambridge Graphene Centre, offers a soberly optimistic view of the future of graphene in this area: "Graphene and Related Materials have great promise in the field of energy storage and conversion. The Graphene Flagship has identified energy applications as a key area of investment."

"We hope that our critical overview will guide researchers in academia and industry to identify optimal pathways toward applications and implementation, with an eventual benefit to society as a whole."

Source: <http://graphene-flagship.eu>

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