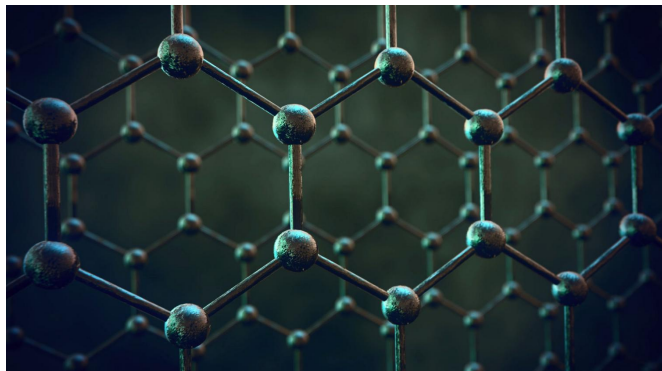


Non-flammable graphene membrane developed for safe mass production

12 April 2017



This visualisation shows layers of graphene used for membranes. Credit: University of Manchester

University of Arkansas researchers have discovered a simple and scalable method for turning graphene oxide into a non-flammable and paper-like graphene membrane that can be used in large-scale production.

"Due to their [mechanical strength](#) and excellent charge and heat conductivities, graphene-based materials have generated enormous excitement," said Ryan Tian, associate professor of [inorganic chemistry](#) in the J. William Fulbright College of Arts and Sciences. "But high flammability jeopardizes the material's promise for large-scale manufacturing and wide applications."

Graphene's extremely high flammability has been an obstacle to further development and commercialization. However, this [new discovery](#) makes it possible to mass-produce graphene and [graphene membranes](#) to improve a host of products, from fuel cells to solar cells to supercapacitors and sensors. Tian has a provisional patent for this new discovery.

Using metal ions with three or more positive charges, researchers in Tian's laboratory bonded

graphene-oxide flakes into a transparent membrane. This new form of carbon-polymer sheet is flexible, nontoxic and mechanically strong, in addition to being non-flammable.

Further testing of the material suggested that crosslinking, or bonding, using transition metals and rare-earth metals, caused the [graphene oxide](#) to possess new semiconducting, magnetic and optical properties.

For the past decade, scientists have focused on graphene, a two-dimensional material that is a single atom in thickness, because it is one of the strongest, lightest and most conductive materials known. For these reasons, graphene and similar two-dimensional materials hold great potential to substitute for traditional semiconductors. Graphene oxide is a common intermediate for graphene and graphene-derived materials made from graphite, which is a crystalline form of carbon.

The researchers' findings were published in *The Journal of Physical Chemistry C*.

More information: Hulusi Turgut et al. Multivalent Cation Cross-Linking Suppresses Highly Energetic Graphene Oxide's Flammability, *The Journal of Physical Chemistry C* (2017). [DOI: 10.1021/acs.jpcc.6b13043](#)

Provided by University of Arkansas

APA citation: Non-flammable graphene membrane developed for safe mass production (2017, April 12) retrieved 27 November 2020 from <https://phys.org/news/2017-04-non-flammable-graphene-membrane-safe-mass.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.