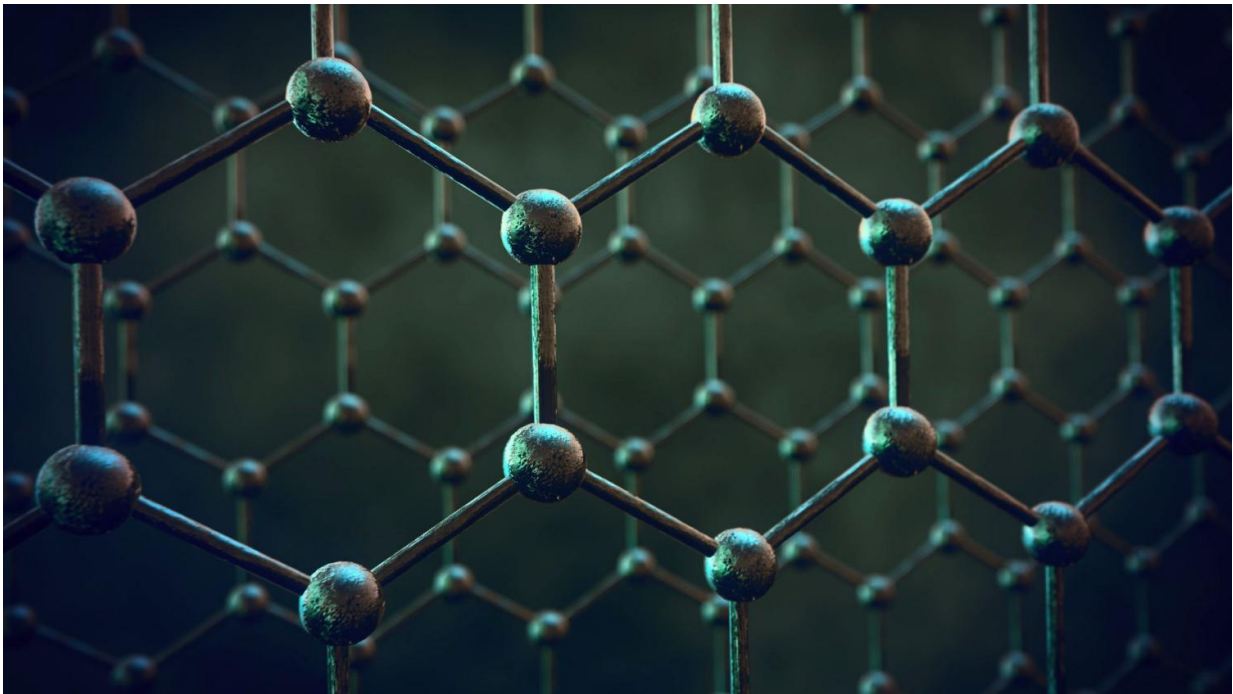


Non-flammable graphene membrane developed for safe mass production

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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](https://doi.org/10.1021/acs.jpcc.6b13043)

Provided by University of Arkansas

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