Camera flash turns an insulating material into a conductor

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An insulator can now be transformed to conduct electricity by an ordinary camera flash.

A Northwestern University professor and his students have found a new way of turning graphite oxide -- a low-cost insulator made by oxidizing graphite powder -- into graphene, a hotly studied material that conducts electricity. Scientists believe graphene could be used to produce low-cost carbon-based transparent and flexible electronics.

Previous processes to reduce graphite oxide relied on toxic chemicals or high-temperature treatment. The idea for a simple new process came in a burst of inspiration: Can a camera flash instantly heat up the graphite oxide and turn it into graphene?

The process, invented by Jiaxing Huang, assistant professor of materials science and engineering at Northwestern's McCormick School of Engineering and Applied Science, and his graduate student Laura J. Cote and postdoctoral fellow Rodolfo Cruz-Silva, was published in the Aug. 12 issue of the Journal of the American Chemical Society.

Materials scientists previously have used high-temperature heating or chemical reduction to produce graphene from graphite oxide. But these techniques could be problematic when graphite oxide is mixed with something else, such as a polymer, because the polymer component may not survive the high-temperature treatment or could block the reducing chemical from reacting with graphite oxide.

In Huang's flash reduction process, researchers simply hold a consumer camera flash over the graphite oxide and, a flash later, the material is now a piece of fluffy graphene.

"The light pulse offers very efficient heating through the photothermal process, which is rapid, energy efficient and chemical-free," he says.

When using a light pulse, photothermal heating not only reduces the graphite oxide, it also fuses the insulating polymer with the graphene sheets, resulting in a welded conducting composite.

Using patterns printed on a simple overhead transparency film as a photo-mask, flash reduction creates patterned graphene films. This process creates electronically conducting patterns on the insulating graphite oxide film -- essentially a flexible circuit.

The research group hopes to next create smaller circuits on a single graphite-oxide sheet at the single-atom layer level. (The current process has been performed only on thicker films.)

"If we can make a nano circuit on a single piece of graphite oxide," Huang says, "it will hold great promise for patterning electronic devices."

Source: Northwestern University (news : web)