Transparent film uses graphene for stable, light-responsive applications

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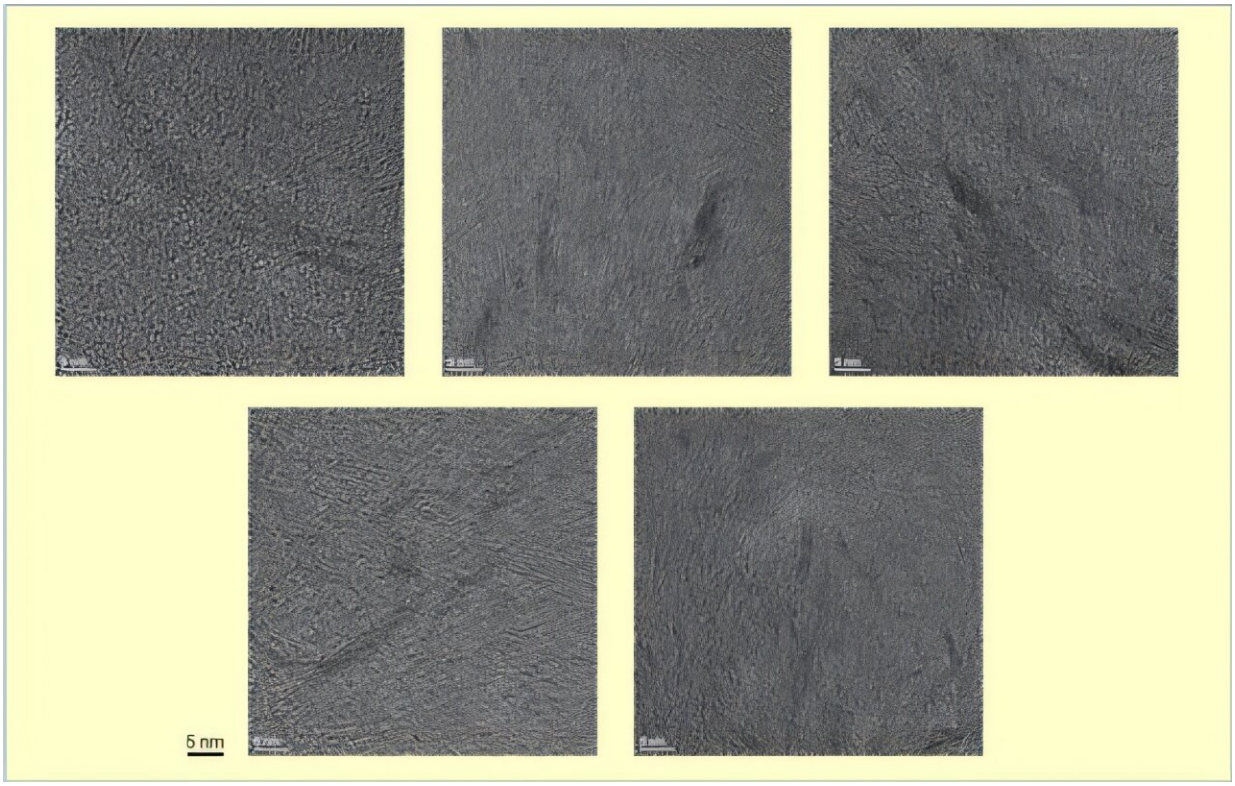


Transmission electron micrograph showing 5 to 8 layers of graphene with an area of tens of nanometers spaced at 0.35 nanometer intervals evenly dispersed within a film-like photocured polymer material. Credit: Electronics and Telecommunications Research Institute(ETRI)

Korean researchers have succeeded in developing an innovative

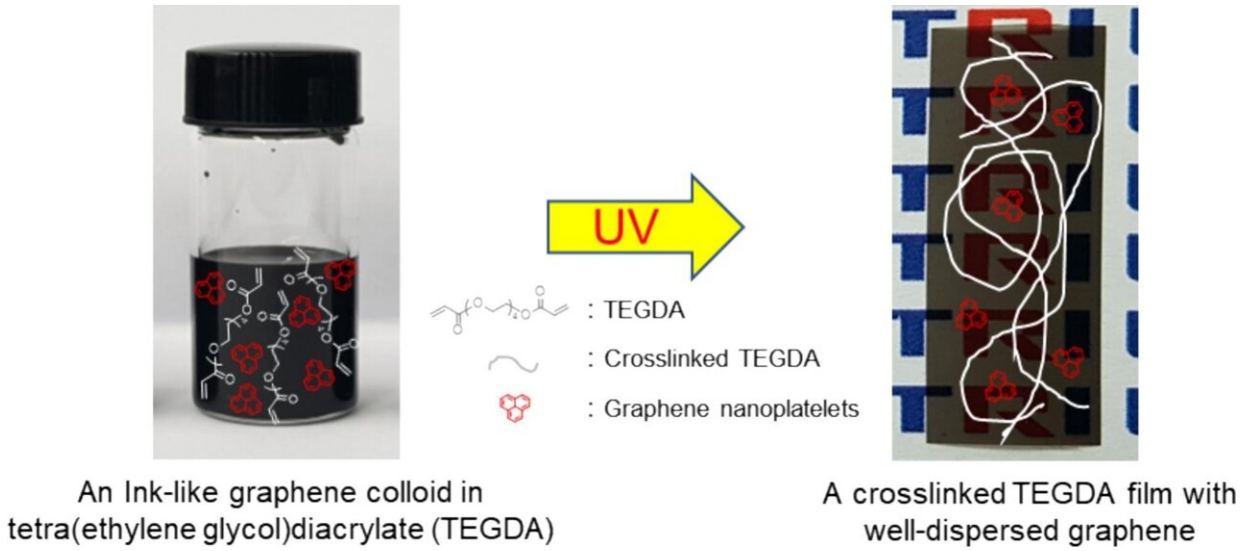
transparent film using graphene. This development secures a new material technology that makes it easier to utilize new graphene materials, and it is expected to be widely used in fields such as lasers, optics, displays, and materials in the future.

Researchers at the Electronics and Telecommunications Research Institute (ETRI) have developed a new transparent film that stably disperses graphene. The film's transparency changes depending on the intensity of light, and is expected to be used in a variety of fields, including laser protection devices, smart optical sensors, and artificial intelligence (AI) photonic materials.

Graphene is attracting attention as a next-generation innovative material due to its excellent strength and electrical conductivity. However, it has been difficult to use in actual industries due to the problem of adhering together. Chemical dispersants were used to solve this problem, but it was difficult to keep the graphene's properties intact.

ETRI researchers have developed a new photocurable graphene-dispersed colloid and secured the technology to enable graphene to be stably and uniformly dispersed within a polymer without a dispersant. Based on this, it has become possible to easily manufacture graphene dispersed films and molds.

This graphene colloid is so stable that it can be stored for long periods of time, more than a year, without graphene precipitation. They also used light (UV) to convert the colloidal layer into a hard film, creating a new material that is easy to process while retaining the properties of graphene.



Graphical abstract. Credit: *Composites Part A: Applied Science and Manufacturing* (2024). DOI: 10.1016/j.compositesa.2024.108693

The researchers explained that the technology is environmentally friendly because the graphene-dispersed solution polymerizes to form the film and the entire graphene colloid is used to form the film, so no pollutants are generated. In addition, they explained that since it is a film manufacturing method employing light (UV) curing of the graphene colloid, it is advantageous for commercialization because it can be mass-produced in a continuous process, unlike conventional film-making methods that use molds or polymer solutions.

The developed graphene-dispersed photocurable transparent film can be applied in various industries such as optics, electronics, and AI by utilizing graphene's unique light-regulating properties, or optical nonlinearity.

First, it can detect and block strong light, so it would be great as a laser sensor and protective film to protect your eyes or equipment. It is also

expected to be applied to smart optical sensors that can control the intensity of light and detect changes to create more precise advanced sensors, and AI optical materials that AI uses to perform computations using light. Utilizing transparent and uniform films could also have significant implications for the development of high-performance displays and optical devices, the researchers said.

Shin Hyung Cheol, director of the Human Enhancement & Assistive Technology Research Section, said, "This research paves the way for easier utilization of graphene. It will be an innovative material, especially in optical-related components and AI applications."

ETRI researchers plan to continue further research to develop more precise and efficient optical and electronic materials by utilizing graphene's diverse properties. They are also working with related companies to consider cooperation regarding commercialization research and mass production systems.

The ETRI research team published the results of this study in March in the journal *Composites Part A: Applied Science and Manufacturing*.

More information: Seung Koo Park et al, A semipermanently stable, photocrosslinkable graphene colloid: A fresh strategy for fabricating polymer nanocomposites, *Composites Part A: Applied Science and Manufacturing* (2024). DOI: 10.1016/j.compositesa.2024.108693