Large-Area Graphene Fabrication Method

Grolltex and Graduate student at UC San Diego
Univ. California
University of California, San Diego (UC San Diego)

Graphene is pure carbon in the form of a very thin, nearly transparent sheet, one atom thick. It is remarkably strong for its very low weight (100 times stronger than steel) and it conducts heat and electricity with great efficiency. Graphene research has expanded quickly since the substance was first isolated in 2004.

Graphene is expected to play a significant role in future technologies that span a range from consumer electronics, to devices for the conversion and storage of energy, to conformable biomedical devices for healthcare. To realize these applications, however, a low-cost method of synthesizing large areas of high-quality graphene is required. Currently, the only method to generate large-area single-layer graphene that is compatible with roll-to-roll manufacturing destroys approximately 300 kg of copper foil (thickness = 25 μm) for every 1 g of graphene produced.

> *The most common approach used to build graphene devices is to grow the polycrystalline*

> *graphene via chemical vapor deposition on a thin metal foil, followed by transfer of the graphene to the substrate of interest. This process can produce large areas of graphene with good control over the thickness.*

However, the graphene is often wrinkled because the metal foil substrate is rough. Furthermore, the relative crystallographic orientation of the domains is random because of the lack of registry with the substrate.

Nanoengineers from UC San Diego have developed a new environmentally benign and scalable process of transferring graphene to flexible substrates. Their green method for fabricating graphene sheets reduces the costs and the time required to perform the transfer and enables the synthesis of graphene on an industrial scale.

The process is based on the preferential adhesion of certain thin metallic films to graphene; separation of the graphene from the catalytic copper foil is followed by lamination to a flexible target substrate in a process that is compatible with rollto-roll manufacturing. The copper substrate is indefinitely reusable and the method is substantially greener than the current process that uses corrosive iron(III) chloride to etch the copper. The quality of the graphene produced by this new process is similar to that produced by the standard method, given the defects observable by Raman spectroscopy. Green, inexpensive synthesis of high-quality single-layer graphene will enable applications in flexible, stretchable, and disposable electronics, low-profile and lightweight barrier materials, and in large-area displays and photovoltaic modules.

To see available technologies from research institutions, click here to visit the AUTM Innovation Marketplace.