Modulating Surface Wetting of 2D Materials

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Categories:
- Chemistry and Chemical Analysis
- Materials and Manufacturing

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- Graphene
- Materials and Manufacturing
- Molecular Chemistry
- Polymers
- Surface Chemistry
- Surface Patterning
- Surface Treatment

Lying down layers of molecules have been used to coat the surface of graphene for several years, as a means of controlling its electronic structure, as well as to prevent the adsorption of contaminants from the atmosphere. With the integration of graphene and other 2D materials into hybrid materials and devices, it becomes more important to understand the response of these lying down layers of molecules to the presence of solvents and other environmental stimuli, such as heating, commonly used in device processing. Lying-down molecular layers typically lack strong covalent bonds to the 2D material substrate, so there is a significant potential for removal of molecules in the layer when the surface is exposed to solvents.

Researchers at Purdue University found that surface wetting of graphene and other 2D materials can be tuned based on a reaction intended to stabilize the surface coating, which also selectively destabilizes parts of the coating. In addition, the polymerizable group, which is broadly considered to be a tool for stabilizing the monolayer structure, can also be used to selectively destabilize sections of the monolayer to expose specific functional groups. Moreover, it is possible to re-tether ends of the molecule to the surface, which means that the dynamic behavior is switchable. This technology displays significant control over wetting of 2D materials such as graphene can be achieved by controlling the motion and ordering of ligand molecules that are noncovalently adsorbed to the surface.

This technique can be used to make the surface more hydrophilic or more hydrophobic and can potentially be used in multicomponent coatings to modify local wetting to pattern the surface for integration into hybrid material applications.

Advantages:
-Effective
-Selective
-Adaptable
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Potential Applications:
-Hybrid materials
-Solution processing
-Surface wetting

People:

- Claridge, Shelley A (Project leader)
- Bang, Jae Jin
- Russell, Shane Richard
- Villarreal, Terry Angelo

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Contact OTC:

Purdue Office of Technology Commercialization
1801 Newman Road
West Lafayette, IN 47906

Phone: (765) 588-3475
Fax: (765) 463-3486
Email: otcip@prf.org