In Situ Thermal Control Device

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Categories:
- Chemistry and Chemical Analysis
- Micro & Nanotechnologies

Keywords:
- Chemistry and Chemical Analysis
- Graphene
- Heat Transfer
- Micro & Nanoelectronics
- Photovoltaics
- Surface Chemistry

There is substantial interest in the control of graphene and other layered material surface chemistry using horizontally oriented monolayers. Control over substrate temperature is a critical factor in controlled formation of large ordered domains of horizontally oriented monolayers on technologically important layered material substrates. Most researchers deposit such monolayers by drop casting, i.e., a diluted solution of the molecule being assembled is deposited directly on the substrate and the solvent is either wicked off or evaporated. Such protocols are typically not scalable to large areas because capillary forces during film drying lead to unacceptably large variations in film thickness and ordering across the sample.

Researchers at Purdue University have developed a compact temperature control device that enables control over substrate temperature prior to and during transfer of molecular monolayers using Langmuir-Schaefer techniques. Langmuir-Schaefer transfer does not require drying of solvent on the surface, and potentially, offers a straightforward way of transferring well-controlled patterns with features on scales from nanometers to centimeters or large ordered areas of a single surface chemistry. However, a growing body of literature has indicated that water and other adsorbates adsorbed on layered material surfaces can substantially alter their wetting properties. Elevated temperatures were used to both drive off residual water prior to contact with the molecular pattern being transferred and to increase ordering of transferred molecules in the manner of thermal annealing processes commonly used in 3D materials.

Advantages:
-Provides temperature control during transfer of substrates
-Controlled formation of large ordered domains
-Increases domain sizes multiple orders of magnitude
-Eliminates large variations in film thickness, which is common with drop casting

Potential Applications:
-Classes of materials relevant to organic photovoltaics or nanoelectronics
-Integrate into commercial laboratory Langmuir troughs or larger scale industrial processes

People:

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Intellectual Property:

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