Nanoscale Directional Wetting

**Track Code:** 2017-CLAR-67699

**Categories:**
- Chemistry and Chemical Analysis
- Micro & Nanotechnologies

**Keywords:**
- Chemistry and Chemical Analysis
- Electronics
- Materials Science
- Micro & Nanotechnologies
- Optoelectronics
- Organic Chemistry
- Surface Patterning

A number of major challenges in materials and surface chemistry relate to patterning thin film structures with nanoscopic dimensions. For instance, nanoscale device design frequently requires patterning of two or more chemically different materials at dimensions less than 10 nm, approaching the molecular scale. Patterning nanoscopic wetting near the molecular scale is especially challenging for synthetic material applications, such as nanoelectronic or organic photovoltaic devices, in which process-induced variability at sub-20-nm scales present a major barrier to continued miniaturization. However, nature routinely utilizes nanoscopic wetting control at similar scales to build interfaces of striking geometric precision and functional complexity, suggesting the possibility of leveraging similar control in synthetic materials.

Researchers at Purdue University have developed a method for controlling ultrathin film structures using sitting phases of polymerizable phospholipids. Such phases are capable of providing nanoscopic directional wetting confinement near the molecular scale for ultrathin films under appropriate deposition conditions or, alternatively, of stabilizing spreading of slightly thicker nanoscopic films. The surface chemistry is compatible with scalable solution-processing methods including spray coating. This method uses monolayers with thicknesses less than 0.5 nm, minimizing electrical resistance in comparison with thicker monolayers. Because the headgroup chemistry is modular, it can be modified to control wetting of a variety of technologically relevant materials including classes of materials relevant to organic optoelectronics or nanoscale electronics.

**Advantages:**
- Precise control of ultrathin film architectures
- Modifiable to control wetting of a variety of technologically relevant materials
- Compatible with scalable processing methods such as spray coating
-Sub-nm interlayer chemistry results in minimal electrical barrier

Potential Applications:
- Materials and surface chemistry
- Organic optoelectronics or nanoscale electronics patterning

People:
- Claridge, Shelley A (Project leader)
- Bang, Jae Jin
- Choong, Shi Wah
- Russell, Shane Richard

Intellectual Property:

Applican


d Date: January 19, 2018
Type: Utility Patent
Country of Filing: United States
Patent Number: 10,525,502
Issue Date: January 7, 2020

Application Date: October 28, 2019
Type: DIV-Patent
Country of Filing: United States
Patent Number: (None)
Issue Date: (None)

Application Date: January 23, 2017
Type: Provisional-Patent
Country of Filing: United States
Patent Number: (None)
Issue Date: (None)

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