Enhanced Block Copolymer Self-Assembly
Tech ID: 31934 / UC Case 2012-739-0

BACKGROUND
Self-assembled block copolymers have broad applications from drug delivery to OLED displays. Researchers at the University of California, Santa Barbara have introduced the following technologies that leverage block copolymer self-assembly to achieve new advantages in these applications.

DESCRIPTION
Spatial and Temporal Control of Brush Formation on Surfaces

US Patent No. 9081283
UC Case 2012-739

Spatial and temporal control over polymer chain growth from surface bound initiators using light. Polymerization can be achieved wherever the surface is irradiated with light, allowing for spatial control over chain growth. Film thickness can be controlled by varying the exposure time or intensity of light. These features allow for the facile patterning of substrates with tethered polymer chains.

Composition for Controlled Assembly and Improved Ordering of Silicon-Containing Block Copolymers

US Patent No. 20150376455
UC Case 2013-135

Facile control of silicon-containing block-copolymers using non-polymeric additives. This technology provides excellent control over the structure of block copolymers at the 5-100 nm scale, either in the bulk or in thin films, including photovoltaics, photonic crystals, nano-porous membranes, nanolithography, amongst others.

Junction-Functionalization of Block Copolymers for Improved Assembly

US Patent No. 9315637
UC Case 2013-512

Self-assembly and ordering of block copolymers by functionalizing the junction between the blocks with an ionic group. This technology allows for reduced interfacial width and improved long-range ordering. The long range ordering is critical for many applications where control over the structure of block copolymers at the 5-50 nm scale is required. Reduced interfacial width is particularly attractive for block copolymer nanolithography as it allows the creation of tridimensional structures with sharp edges.

Copolymer Formulation for Directed Self-Assembly

US Patent No. 9772554
Directed self-assembly (DSA) lithography using polymer blends consisting of linear AB diblock copolymers and bottle brush polymers with A and/or B grafted arms. This technology enables smaller cylinder formation by DSA in guided pre-patterns, in addition to accessing longer process windows in DSA lithography. It also eliminates defective hole shrinks, broken cylinders, dislocations and disclination defects, and is implementable at a lower cost than other lithographical methods that enable sub-10 nm patterns.

Photo Patterned Growth of Electronically Active Polymer Brushes for Light Emitting Diode Displays

US Patent No. 10211400

UC Case 2017-145, 2017-414

Three-dimensional patterning using light with electronically-active, emissive polymers grafted from initiator-functionalized surfaces. This technology represents a practical and inexpensive technique to produce organic light emitting diode (OLED) displays where the photocatalyst necessary for polymer growth also serves as an active component in the emissive layer.

Patterned Discrete Nanoscale Doping of Semiconductors via Block Copolymer Thin-Film Self-Assembly

US Patent No. 20200020538

UC Case 2017-981

Patterned, discrete and ultra-shallow doping of Si semiconductors by leveraging block copolymer (BCP) self-assembly. This novel synthesis strategy is developed to obtain dopant-containing BCP, where the dopant is covalently attached. This technology combines BCP self-assembly and semiconductor doping, thus circumventing conventional BCP lithography and ion implantation, achieving lateral nanoscale order and ultra-shallow junctions in Si on a large area at low cost. The dosage and junction depth can be easily tuned by the annealing conditions.

PATENT STATUS

<table>
<thead>
<tr>
<th>Country</th>
<th>Type</th>
<th>Number</th>
<th>Dated</th>
<th>Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States Of America</td>
<td>Issued Patent</td>
<td>9,081,283</td>
<td>07/14/2015</td>
<td>2012-739</td>
</tr>
</tbody>
</table>

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Mussel-Inspired Underwater Adhesives/Coatings From Renewable Resources
- Colorimetric Sensing Of Amines.
- High Energy-Density Polymer Electrolytes for Batteries and Energy Storage