



## Fabrication of Complex 3-D Structures Based on Directed Assembly of Self-Assembling Materials

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**The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing methods of fabricating a thermodynamically stable three-dimensional structure that varies perpendicularly to its substrate.**

### Overview

Block copolymer materials self-assemble at the nanometer scale. A chemically patterned substrate can direct the self-assembly, replicating the two-dimensional pattern upwards into the block copolymer material. However, this structure is not truly three-dimensional, as it is unchanging in the vertical direction.

### The Invention

UW-Madison researchers have developed methods of fabricating a thermodynamically stable three-dimensional structure that varies perpendicularly to its substrate. They mismatched the symmetry of the substrate pattern to the block copolymer. When the copolymer is heated above its glass transition temperature, ordering of the material is induced. The interaction of the ordered copolymer with the mismatched substrate alters the energy balance so that three-dimensional structures are the most energetically favorable. As the copolymer materials self-assemble in the upward direction, they transition from following the exact pattern of the substrate to exhibiting a complex three-dimensional morphology.

### Applications

- Nanoelectric devices
- Separation membranes
- Catalysts
- Fuel cells

### Key Benefits

- Three-dimensional structures are controllable and reproducible
- Shape can be controlled by adjusting substrate pattern or copolymer composition
- Can reduce cost of nanoscale manufacturing

### Additional Information

#### Related Intellectual Property

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