

# 中国科学院长春应用化学研究所

## 应用化学学术讲座

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报告时间	2011年11月9日, 上午9: 30
报告地点	主楼410会议室
报告人背景	 <p>Paul F. Nealey, Milton J. and A. Maude Shoemaker Professor, graduated with his PhD under the supervision of Robert Cohen in Chemical Engineering from MIT in 1994. From 1994-1995, he performed postdoctoral research in the laboratory of George M. Whitesides at Harvard University. He has served on the faculty of the Department of Chemical and Biological Engineering at the University of Wisconsin (UW) since 1995. Paul Nealey's research interests include nanofabrication techniques that incorporate the principles of self-assembly into advanced lithography processes, dimension dependent material properties of nanoscopic macromolecular systems, and the design of biomimetic nanostructured surface for cell culture. He has over 200 publications and patents. He has received the National Science Foundation (NSF) Career Award, the Camille Dreyfus Teacher-Scholar Award, and the Arthur K. Dolittle Award in 2004 from American Chemical Society. He is a Fellow of American Physical Society. He serves as the Director of the Semiconductor Research Corporation Advanced Lithography Program at UW, and is the Founding Director of the UW NSF Nanoscale Science and Engineering Center in Templated Synthesis and Assembly at the Nanoscale.</p>

## **Directed Assembly of Block Copolymer Films on Lithographically Defined Nanopatterned Surfaces**

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Through fundamental understanding of the processes that govern equilibration of block copolymer films in the presence of lithographically defined chemically nanopatterned substrates, we seek to synthesize and assemble such materials to enable fabrication at length scales not possible with traditional photo resists. The underlying motives for pursuing directed assembly of block copolymers for patterning are resolution enhancement and precise control over the shapes and dimensions of patterned features.

Here we investigate the structure of the block copolymer film as a function of the interfacial energy between the blocks of the copolymer film and the regions of the lithographically-defined chemical pre-patterns. Assembly is undertaken under conditions in which the density of features in the domain structure of the film is greater than that of the chemical pre-pattern. For lamellae-forming systems, many bulk- and non-bulk-like morphologies assemble as a function of block-pattern interfacial energy and pattern geometry. Under conditions in which domains are oriented perpendicular to the substrate and define grating structures, we elucidate the interfacial energy parameters for desired shapes and dimensions of the nanostructures.

We also report a strategy to create square and rectangular arrays from films of traditional sphere-forming diblock copolymers with a high degree of perfection, size uniformity, and flexibility in pattern geometry. By carefully controlling the boundary conditions, 1) the (100) plane of the body-centered cubic (BCC) unit cell can be induced to present itself on the surface of the block copolymer film, 2) the BCC morphology can be directed to assemble on lithographically-defined chemically nanopatterned substrates, and 3) the pattern in the surface domain structure of the film can be effectively transferred using molecular transfer printing (MTP).