Low Cost, Large Area Nanopatterning via Directed Self-Assembly

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Molecular self-assembly has several advantages over other nanofabrication methods. Molecular building blocks ensure ultrafine pattern precision, parallel structure formation allows for mass production and a variety of three-dimensional structures are available for fabricating complex structures. Nevertheless, the molecular interaction for self-assembly generally relies on weak forces such as van der Waals force, hydrogen bonding, or hydrophobic interaction. Due to the weak interaction, the structure formation is usually slow and the degree of ordering is low in a self-assembled structure. To promote self-assembly, directed assembly methods employing prepatterned substrates or external fields have been developed and gathered a great deal of technological attention as a next generation nanofabrication process. In this presentation a variety of directed assembly methods for soft nanomaterials including block copolymers, peptides and carbon nanomaterials will be introduced. Block copolymers are representative self-assembling materials extensively utilized in nanofabrication. In contrast to colloid assembly or anodized metal oxides, various shapes of nanostructures, including lines or interconnected networks, can be generated with a precise tunability over their shape and size. Applying prepatterned substrates[1,2] or introducing thickness modulation[3] to block copolymer thin films allowed for the control over the orientational and positional orderings of self-assembled structures. The nanofabrication processes for metals, semiconductors[4], carbon nanotubes[5,6], and graphene[6,7] templating block copolymer self-assembly will be presented.

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Keywords: Self-Assembly