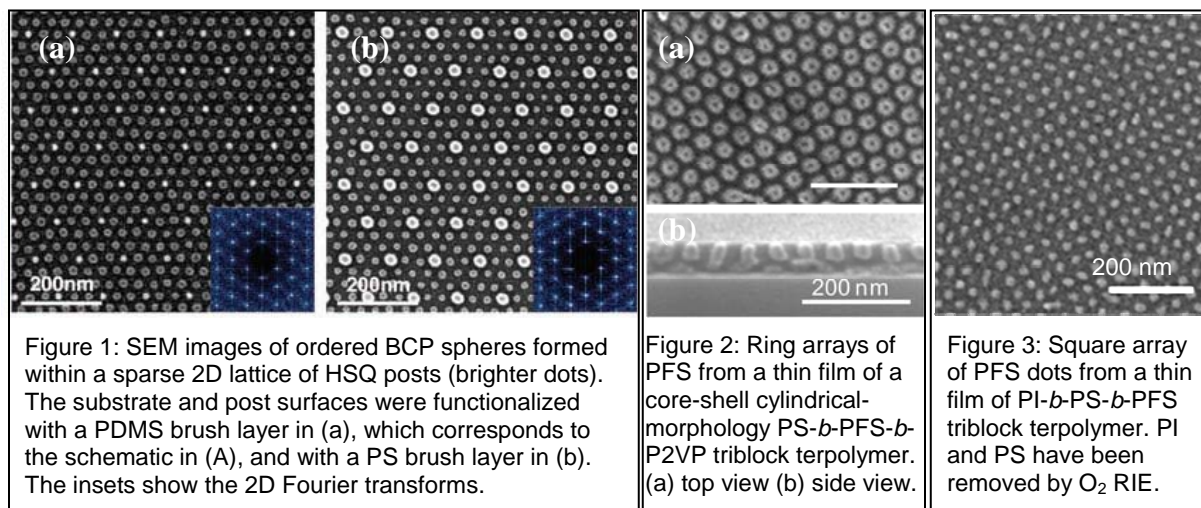


Templated Self-assembly of Block Copolymers for Nanolithography

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Self-organized macromolecular materials can provide an alternative pathway to conventional lithography for the fabrication of devices on the nanometer scale. In particular, the self-assembly of the microdomains of diblock copolymers within lithographically-defined templates to create patterns with long range order has attracted considerable attention, with the advantages of cost-effectiveness, largearea coverage and compatibility with pre-established top-down patterning technologies. Block copolymers consist of two covalently bound polymer chains of chemically distinct polymer materials. The chains can self-assemble to form small-scale domains whose size and geometry depend on the molecular weights of the two types of polymer and their interaction [1]. On the one hand, with the purpose of fabricating arrays of magnetic nanosized dots, which are a potential candidate for magnetic hard-drive media, we are working on templating the block copolymers in a removable template. Previously, sphere-forming poly(styrene-*b*-ferrocenyldimethylsilane) (PS-PFS) diblock copolymers were successfully aligned in 2-D [2] or 3-D [3] templates. In addition, spherical morphology of poly(styrene-*b*-dimethylsiloxane) (PS-PDMS) block copolymers can be templated using an array of nanoscale topographical elements that act as surrogates for the minority domains of the block copolymer, as demonstrated in Figure 1[4] PS-PDMS diblock copolymers have a large interaction parameter and a high etchcontrast between two blocks, which are desirable for long-range ordering and pattern-transfer into functional materials. Concentric ring patterns can also be obtained by using circular templates[5] Beyond rather limited morphologies of diblock copolymers, an appropriate combination of block sequence, interaction parameter of the adjacent blocks, volume fraction, and molecular weights of ABC triblock polymer thin films provides a diversity of new structures. For example, core-shell structured triblock terpolymer can be obtained by designing the block sequence and volume fraction of the blocks. Figure 2 presents vertically oriented high-density nanorings from PS-PFS-P2VP polymers after the selective removal of PS and P2VP [6]. Square arrays of dots can also be achieved from self-assembled triblock terpolymer, as shown in figure 3.



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