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Utilization of Block Copolymer Template Nanolithography for Generating Metal Surface Patterns

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Abstract

Ordered templates of diblock copolymers have been shown to produce patterned arrays of nanostructures on silicon dioxide substrates. These compounds contain mixtures of both hydrophobic and hydrophilic monomers (blocks) that phase separate under the correct conditions to produce nanostructures. Here structures can be perpendicularly aligned on a substrate by using a benzene solvent vapor to selectively swell one of the components of a polymer film consisting of polystyrene (PS) and polyethylene oxide (PEO) on the native oxide of a Si (100) substrate. Recent work has used this method in producing similar ordering of PS-b-PEO on substrates containing tantalum (Ta) and Nickel (Ni). Such ordering can be observed with atomic force and secondary electron microscopy. Other investigations include the growth of metal nanostructures on a Ta substrate by electrodepositing through the polymer template and the effect on the pattern of treatments such as cross linking with UV irradiation to isolate the majority phase (PS) and facilitate the removal of the minority component (PEO) through washing. We believe use of polymer templates in this manner can lead to fabrication methods for producing hard masks for transferring patterns to metal surfaces via reactive ion etching (RIE) or ion beam etching (IBE). Such patterned media could then be used in applications such as magnetic recording, catalysis, and growth of heterostructured material.