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Obtaining Perpendicular Block Copolymer Morphologies with Solvent Annealing KEVIN GOTRIK, JEONG GON SON, ADAM HANNON, CAROLINE ROSS, Massachusetts Institute of Technology — Being able to control block copolymer (BCP) thin film morphology and orientation is of interest for lithographic applications where creation of feature sizes ranging from 10-100nm is desirable. Perpendicular oriented cylinders and lamellae are especially valuable due to their high aspect ratios but are difficult to achieve in BCP systems with a large Flory-Huggins interaction parameter (χ). We explore the morphological phase behavior that films (30-200nm) of poly(styrene-b-dimethylsiloxane) (PS-PDMS, 45kg/mol, χ=0.26) exhibit under different solvent conditions with focus on conditions that produce perpendicular microdomains. The microdomains are revealed by selectively etching the PS with an oxygen plasma (50W CF4). Variation in the solvent vapor conditions results in selective swelling of the different blocks of the copolymer depending on the relative Hildebrand solubility parameters (e.g. PS- 18.5, toluene-18.3 $MPa^{1/2}$), affecting the microdomain morphologies, and the solvent evaporation and deswelling process influences the orientation of the microdomains. Two different strategies are presented involving solvent vapor annealing that result in perpendicular morphologies in films of PS-PDMS and the results are compared with self-consistent field theory modeling of solvent-polymer systems.

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