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**Tunable-Morphology Block Copolymer Thin Films with Controlled Solvent Vapor Annealing for Lithographic Applications** BRIAN STAHL, NATHANIEL LYND, EDWARD KRAMER, CRAIG HAWKER, University of California, Santa Barbara — Solvent annealing is an alternative to thermal annealing for improving long-range order and reducing defect density in block copolymer thin films. However, the fundamentals of block-copolymer self-assembly under solvent annealing conditions have yet to be studied in detail. We have developed a specialized hardware platform to perform solvent annealing experiments with active and precise control over solvent vapor saturation which allows us to quantitatively understand the structure-processing relationship during different stages of solvent annealing. Using polystyrene-*b*-polyethylene oxide/water/toluene as a model system and AFM, TEM and GISAXS characterization, we have found that a decrease in water vapor saturation during the post-annealing quenching step induces a change in domain spacing and reduction in long-range order. We have also found that by changing the water vapor saturation during steady-state annealing we are able to tune the domain spacing over a wide range and that this spacing remains after quenching. This controlled approach to solvent annealing affords considerable control over the morphology of annealed block copolymer thin films and a deeper understanding of the fundamentals of the process, making this technique more relevant to industrial applications.

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