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Tuning the Morphology of Solvent Annealed Thin Films of Polystyrene-b-Polyethylene Oxide with Controlled Saturations of Water and Toluene Vapors BRIAN C. STAHL, EDWARD J. KRAMER, CRAIG J. HAWKER, University of California, Santa Barbara — Solvent annealing can be used to facilitate the self-assembly of block copolymer thin films and has several advantages over thermal annealing including room-temperature processing, domain orientation control and the ability to anneal polymers not amenable to thermal processing. We have developed a controlled process design for performing solvent annealing that incorporates continuous flows of solvent-saturated carrier gas, multiple simultaneous co-solvents and in-situ metrology. This new method is modular and applicable to a wide range of block copolymer and solvent systems. The control over annealing and quenching conditions afforded by this new technique allows us to reproducibly control the domain orientation and periodicity in thin films of cylinder-forming polystyrene-b-polyethylene oxide (PS-b-PEO) annealed in environments with high saturations of water and toluene vapors without modifying the block copolymer or substrate. By adjusting the humidity of the quenching gas flow we are able to control the orientation of the PEO cylinders, and by adjusting the humidity during annealing we are able to tune the domain spacing of PEO cylinders oriented perpendicular to the substrate.

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