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Investigating Kinetic Pathways During Solvent Vapor Annealing with Soft Shear via In Situ Small-Angle Neutron Scattering CAMERON SHELTON, University of Delaware, RONALD JONES, National Institute of Standards and Technology, THOMAS EPPS, University of Delaware — Solvent vapor annealing with soft shear (SVA-SS) is a block polymer (BP) thin film annealing technique that directionally aligns nanostructures by exploiting solvent swelling/deswelling differences between the film and a polydimethylsiloxane (PDMS) pad adhered to the free surface. Although studies have demonstrated the potential of SVA-SS to generate well-aligned domains, the restructuring mechanism and effect of key parameters requires investigation to improve control over self-assembly. In this work, we conducted in situ small-angle neutron scattering experiments to explore the kinetic pathways of nanostructure alignment of poly(d-styrene-b-isoprene-b-d-styrene) thin films during SVA-SS. We compared results to SVA (without shear) and determined that alignment occurred through domain breakup and reformation initiated by PDMS swelling and deswelling, respectively. Additionally, changes in parameters such as PDMS elasticity and deswell rate resulted in nonlinear trends in domain directionality and ordering that were not apparent by small-area atomic force microscopy analysis. By relating the key thermodynamic effects to measured kinetic pathways for alignment, we have generated a more optimized approach to direct BP thin film self-assembly using SVA-SS.

Cameron Shelton
University of Delaware

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