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Tracking Solvent Distribution in Block Polymer Thin Films with In Situ Solvent Vapor Annealing during Neutron Scattering CAMERON SHELTON, University of Delaware, RONALD JONES, JOSEPH DURA, National Institute of Standards and Technology, THOMAS EPPS, University of Delaware —

Solvent vapor annealing (SVA) is a potential route to controlling the self-assembly of block polymer nanostructures in thin film geometries as it harnesses the ability to tune substrate surface, free surface, and polymer-polymer interactions simultaneously. However, the effect of parameters such as solvent preference and solvent partial pressure on nanostructure self-assembly is still poorly understood. Herein, we quantified the degree of preferential segregation of d-benzene into polystyrene domains of cylinder-forming poly(styrene-b-isoprene-b-styrene) as a function of film thickness and solvent partial pressure. Additionally, measurable changes in lateral domain spacing, vertical layer spacing, film thickness, and the number of stacked domains at set partial pressures were used to determine how solvent-polymer interactions affected nanostructure reorganization. These in situ experiments were conducted with a combination of small-angle neutron scattering (SANS) and neutron reflectivity (NR), which allowed us to obtain a 3-D profile of solvent distribution and nanostructure self-assembly. By studying the underlying solvent-polymer interactions, this work provides an improved understanding of the mechanisms responsible for nanostructure reorganization during SVA.

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