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An in situ GISAXS study of BCP thin films during annealing in selective solvent vapor: Solvent removal effects in films of different initial thickness[1] ILJA GUNKEL, Lawrence Berkeley Natl Lab, XIAODAN GU, University of Massachusetts Amherst , ALEXANDER HEXEMER, Lawrence Berkeley Natl Lab, THOMAS RUSSELL, University of Massachusetts Amherst — Solvent vapor annealing is a rapid and effective means to achieve well-ordered structures in block copolymer (BCP) thin films. The underlying physical mechanisms however are ill understood and systematic studies of the annealing process are scarce. Here, we used grazing-incidence small-angle x-ray scattering (GISAXS) to investigate the ordering of BCP microdomains as solvent vapor was added or removed. We studied polystyrene-block-poly(4-vinyl pyridine) (PS-b-P4VP) BCP thin films of different initial thickness ranging from a few ten to a few hundred nanometers during annealing in THF vapor, a selective solvent for PS. While the degree of lateral order of the BCP microdomains in the swollen state was found to be exceptional for all film thicknesses, the packing of microdomains was found to depend on the initial film thickness and the amount of swelling. The effect of solvent removal on the degree of lateral order was studied by deswelling films of different thickness at different removal rates. Here, we observed a substantial deterioration of lateral order of microdomains that is significantly stronger than in comparable deswelling studies of BCP thin films in neutral solvent vapors.

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