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Pathways toward unidirectional alignment in block copolymer thin films on faceted surfaces ILJA GUNKEL, Adolphe Merkle Institute, XIAODAN GU, Stanford University, ABHINAV SARJE, ALEXANDER HEXEMER, Lawrence Berkeley National Laboratory, THOMAS RUSSELL, University of Massachusetts Amherst — Solvent vapor annealing (SVA) has been shown recently to be an effective means to produce long-range lateral order in block copolymer (BCP) thin films in relatively short times. Furthermore, using substrates with faceted surfaces allows for generating unidirectionally aligned BCP microdomains on the size scale of an entire wafer. While in recent years SVA has been largely demystified, the detailed pathways toward obtaining unidirectional alignment still remain unclear. Grazing-incidence X-ray scattering (GISAXS) is a very powerful tool for characterizing the structure and morphology of BCPs in thin films, and is particularly useful for studying structural changes in BCP thin films during SVA. We here present in situ GISAXS experiments on cylinder-forming PS-b-P2VP BCP thin films on faceted Sapphire substrates during annealing in THF. We show that the degree of alignment of cylindrical microdomains is greatly enhanced at solvent concentrations close to the order-disorder transition of the copolymer. Furthermore, we observed that inducing disorder by further increasing the solvent concentration and subsequent quenching to the ordered (not yet glassy) state induced the highest degree of alignment with nearly unidirectional alignment of the microdomains in less than 30 min.

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