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Orientational Change of Microphase-Separated Domains of Block Copolymer Thin Films Placed on Ordered Nanoparticle Monolayers
KOOKHEON CHAR, TAEHEE KIM, Seoul National University — Orientation of microphase-separated domains of diblock copolymer (BCP) thin films deposited on ordered nanoparticle (NP) monolayers was investigated. Ordered NP monolayers were prepared on silicon substrates with the Langmuir-Blodgett deposition technique. Parallel orientation of anisotropic microdomains (cylinders and lamellae) of BCP thin films with respect to the substrate is preferred on bare silicon substrates due to the preferential enthalpic interaction with one of BCP blocks, while the perpendicular orientation is preferred on the lattice-like ordered NP monolayers due to the roughness induced from the NP monolayers which can exert elastic deformation on the parallel-oriented microdomains, suppressing the substrate-induced parallel orientation. The effects of NP size as well as BCP film thickness on the orientation of BCP domains were systematically studied with AFM and Grazing Incidence Small-Angle X-ray Scattering (GISAXS). The rectification of perpendicularly oriented BCP microdomains onto underlying NP lattices was analyzed with SEM for thin BCP films (less than 100 nm in thickness). With this experimental technique, we observed the persisted perpendicular orientation of BCP microdomains on NP vacant sites up to the width of NP vacant sites less than 290 nm ($\sim$ 11 L_o).

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