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Polarized Resonant Critical Dimension Small Angle X-Ray Scattering for the Characterization of Polymer Patterns CHRISTOPHER LIMAN, DANIEL SUNDAY, HYUN WOOK RO, LEE RICHTER, ADAM HANNON, R. JOSEPH KLINE, National Institute of Standards and Technology — Critical dimension small angle X-ray scattering (CDSAXS) is a recently developed technique that enables the characterization of the three-dimensional shape of periodic patterns, such as directed self-assembled (DSA) block copolymer (BCP) lamellae thin films. Information about the polymer patterns is extracted by fitting simulated scattering patterns to the experimental ones using an inverse iterative algorithm. Conducting CDSAXS at resonant energies near the carbon or nitrogen edge can enhance the strength of the scattering, but also causes the scattering to be influenced by any anisotropic orientation of the polymer chains. In this work, to assess the degree to which the scattering may be influenced by orientation, we simulate polarized resonant CDSAXS patterns for BCP lamellae with varying degrees of orientation, as well as orientation as a function of location within the lamellae, for different polarizations of the incident X-rays. Also, to assess the influence of a higher degree of orientation, we use capillary force lithography to pattern nanogratings of two semiconducting homopolymers which are known to orient strongly. We characterize these nanogratings, which have similar length scales to DSA BCP lamellae, with polarized resonant CDSAXS and spectroscopic ellipsometry. Finally, we fit simulated CDSAXS and ellipsometric data to the experimental data to obtain information about the shape and the orientation of the nanogratings.

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