

Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Characterizing Molecular Orientation with Polarized Resonant Critical Dimension Small Angle X-Ray Scattering CHRISTOPHER LIMAN, DANIEL SUNDAY, HYUN WOOK RO, LEE RICHTER, THOM GERMER, R. JOSEPH KLINE, National Institute of Standards and Technology — Critical dimension small angle X-ray scattering is a recently developed variable angle transmission technique that enables the characterization of the three-dimensional shape of periodic nanostructures such as the buried interfaces of directed self-assembled block copolymer lamellae. By using this technique at resonant soft X-ray energies with different polarizations to analyze polymer nanostructures, we not only improve the scattering contrast but also gain information about the preferential molecular orientations of these nanostructures. The information about shape and molecular orientation is convolved in the scattering and must be extracted by comparing it to simulated scattering and fitting using an inverse iterative algorithm. We first compare simulated scattering generated using rigorous couple wave analysis and a simpler optical model, and address questions of fit uniqueness. We then test this technique on model systems of polymer nanogratings fabricated using replica molding and nanoimprint lithography. Carbon 1s- π^* transition energies are used to probe the biaxial orientation of the aromatic rings in the polymer backbones. Distinct asymmetry in the scattering pattern results from the interaction of the beam geometry and the change in orientation across a periodic repeat unit, improving fit uniqueness. Fits of the scattering are compared to results from spectroscopic ellipsometry.

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Date submitted: 11 Nov 2016

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