LIQUID CRYSTAL MATERIALS RESEARCH CENTER

SPECIAL SEMINAR SERIES

Interface correlations, surface fluctuations, and lateral structure in diblock copolymer brushes

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Polymer brushes are monomolecular films in which each polymer chain is tethered at one end to a substrate. This tethering leads such films to behave very differently for films of untethered chains. In diblock copolymer brushes each chain contains two portions, or blocks, in which all the repeat units are the same, but the repeat units of the two blocks differ. We are probing the structure of such brushes with X-ray and neutron scattering techniques. Correlation between the interior interface and air surface of a diblock brush has been detected using longitudinal diffuse X-ray scattering and specular X-ray reflectivity. Polystyrene-*b*-polymethacrylate brushes were synthesized by sequential polymerization of first polystyrene and then polymethylacrylate using Atom Transfer Radical Polymerization. The amplitude of the fringes in the longitudinal diffuse scattering decreases with increasing thickness of the polymer brush, indicating the interactions between substrate and brush surface decrease as the thickness of the layers increases. Correlation of the roughnesses of the top and bottom interfaces of the brush is observed after annealing the brush at a temperature above the glass transition temperatures of both polymers. This correlation is lost after the brush is swollen in the vapor of a nonselective solvent, dichloromethane. An emerging technique, Grazing Incidence Small Angle X-ray Scattering (GISAXS), has been used to study lateral structure in the brushes as well. Our initial results show, for the first time, direct evidence of lateral correlations that are present for several samples with various sizes of blocks.

This work has been done in collaboration with Bulent Akgun and William J. Brittain at UA, Jin Wang, Xuefa Li, and Dongryeol Lee at the Advanced Photon Source, and Charles Majkrzak at NIST.

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