

Wednesday June 30th 11:55–12:15

Neutron Reflectometry Studies of Polymer Brushes in Confined Geometry

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Polymer molecules at solid or fluid interfaces have an enormous spectrum of applications in a wide variety of technologies as lubricants, adhesion modifiers, and protective surface coatings. Because polymer brushes have a great potential to be used in such applications, there is a need to determine their structure and efficiency in reduced spaces. Using neutron reflectivity and the newly developed Neutron Confinement Cell, we have directly quantified the density distribution of opposing polymer brushes in good solvent conditions under confinement. Our measurements show that the density profile in the overlap region between opposing polymer brushes flattens consistent with predictions from molecular dynamics simulations. In addition, a significant increase in density at the anchoring surfaces due to compression of the brush layers is observed. This compression or collapse of the brushes in restricted geometries strongly suggests that high density brushes do not interpenetrate in good solvent conditions.