Enhanced Mobility of Confined Polymers
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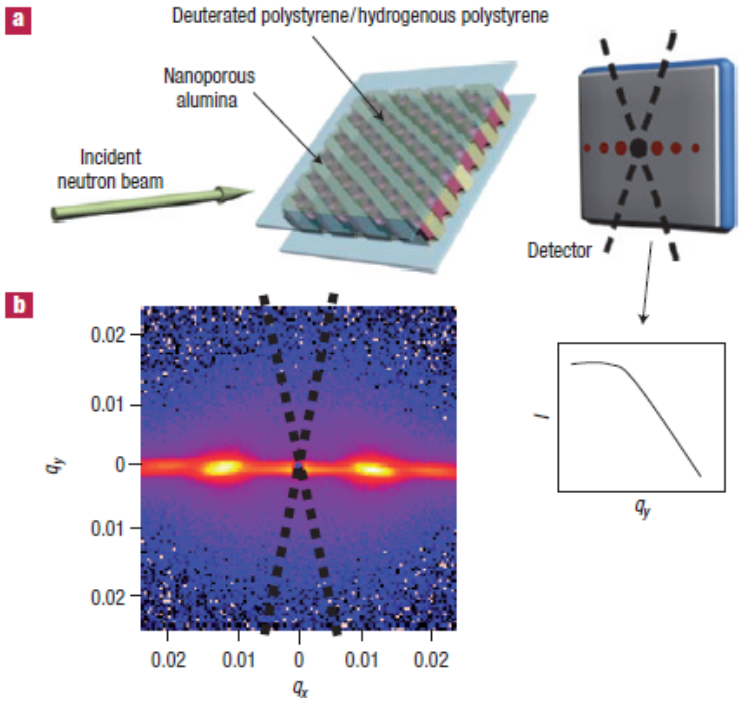
Supporting/Contributing Agencies: DOE/NSF

Quantitative knowledge of the structure and dynamics of confined polymers has significant technological implications in nanofabrication processes. When one of the dimensions of a confining volume is much less than the Rg of the polymers, it is not known what type of perturbations happen to the chain dynamics due to geometric constraints. Tom Russell's group at U.Mass, Amherst by using time-resolved SAXS and SANS investigated the rate of capillary filling of cylindrical nanopores as a function of polymer Mw and the chain conformation. Their studies revealed a reduction in viscosity as evidenced by an increased mobility, increased Mw of entanglement and unperturbed chain conformation (RPA) along pore axis. These results have strong implications in nanoimprint lithography and other nanofabrication processing strategies.



Measurement of overall conformation along nanopore axes via SANS experiment. (a) Schematic diagram of SANS set-up, showing the collimated incident beam, oriented sample, an area detector and the averaged scattered intensity over a range of span from the vertical axis. The uniformly oriented polymer-containing nanopores are tilted to an incidence angle of 30_ relative to the normal incidence of the beam. (**b**) Typical two-dimensional scattering pattern of deuterated polystyrene/hydrogenous polystyrene (61 wt% deuterated polystyrene, Mw of deuterated polystyrene_528 kg mol−1 and Mw of hydrogenous polystyrene_591 kg mol−1) in a nanoporous alumina template (pore diameter_30 nm).

References/Publications

Shin, K., S. Obukhov, J-T. Chen, J. Huh, Y. Hwang, S. Mok, P. Dobrial, P. Thiyagarajan, T. P. Russell, *Nature Mat.* **6**, 961 (2007).