

Scattering Studies on the Order-order Transitions in Block Copolymer Solutions

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The phase behavior of a symmetric styrene-isoprene (SI) diblock copolymer in styrene-selective solvents was investigated by *in-situ* small angle X-ray scattering on shear-oriented solutions. When marginally good solvent was used, intriguing morphological change among close-packed spheres, body-centered cubic spheres, and hexagonally packed cylinders has been observed by varying temperature presumably due to the reduced repulsive interaction. We have shown that the temperature-induced changes in micellar characteristics, particularly in the mean aggregation number, can be quantified in dilute solution, and that this information provides a good guideline to interpret the observed order-order transitions of block copolymer solutions in high concentration. Two nearly symmetric SI copolymers containing perdeuterated block (PS-dPI and dPS-PI) were synthesized and the scattered intensity for these solutions was measured as a function of temperature on the 30 m NG7 spectrometer at NIST. The experimental results obtained demonstrate that the softening of inter-micelle potential with decrease in aggregation number would be the key feature for the various phase transitions.