Lyotropic Phase Behavior of Concentrated Solutions of Diblock Copolymers in an Ionic Liquid

PETER M. SIMONE, Department of Chemistry, University of Minnesota, Minneapolis, MN, TIMOTHY P. LODGE, Department of Chemistry and Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, MN — Concentrated solutions of three different poly((1,2-butadiene)-b-ethylene oxide) (PB-PEO) diblock copolymers in the ionic liquid 1-butyl-3-methylimidazolium hexafluorophosphate [BMIM][PF$_6$] were prepared, and the lyotropic phase behavior of the ordered copolymer nanostructures was investigated via small angle x-ray scattering (SAXS). The three copolymers contained PB blocks of the same length (9 kDa), and different length PEO blocks (3, 4, and 6 kDa). At moderately high concentrations (50-80 wt% polymer) all three of the block copolymers adopted a lamellar morphology, while at very high concentrations (80-95 wt% polymer) the two block copolymers with lower PEO weight fractions formed hexagonally packed cylinders. For lower concentrations (<40-50 wt% polymer), a broadening of the SAXS peaks indicated a loss of long-range order in the copolymer nanostructure.