Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

The melt, lyotropic and aqueous phase behavior of poly(ethylene oxide)-poly(butadiene) block copolymers SUMEET JAIN, FRANK BATES, University of Minnesota — The melt, lyotropic and micellar phase behavior of poly(ethylene oxide)-poly(butadiene) (PEO-PB) block copolymers was studied using small-angle x-ray scattering (SAXS) and cryogenic transmission electron microscopy (cryo-TEM). A series of sample solutions with varying copolymer concentration were investigated for a set of block copolymers spanning a range of composition and molecular weight. The melt phase behavior was consistent with the self-consistent mean-field calculations for diblock copolymers. A sequence of lyotropic liquid crystalline morphologies was documented upon gradual variation of water in block copolymer solutions. Swelling of the hydrophilic domain with addition of water drives phase transitions from cubic $\rightarrow$ hcp $\rightarrow$ lamellar $\rightarrow$ inverse hcp $\rightarrow$ inverse cubic $\rightarrow$ micellar. The results establish that the molecular composition and the extent of swelling are the two main parameters governing the self-assembly of lyotropic phases. Despite the thermotropic nature of the PEO-water interactions, the phase behavior of PEO-PB block copolymers was primarily lyotropic. The evolution of micellar phases depends upon the lyotropic morphology of copolymer solutions prior to the complete saturation of hydrophilic block. The findings are discussed in context of various factors that govern the self-assembly behavior in different regimes.

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Date submitted: 05 Dec 2004 Electronic form version 1.4