Small Angle Neutron Scattering Studies on Blends of Poly (Styrene-ran-Vinyl Phenol) with Liquid Crystalline Polyurethane

RUJUL MEHTA, MARK DADMUN, The University of Tennessee — Molecular composites, composed of uniformly dispersed rigid-rod liquid crystalline polymer (LCP) molecules in a flexible amorphous polymer matrix, have remained hitherto elusive due to a scarcity of miscible systems containing a LCP and an amorphous polymer. The production of such a blend, with an experimentally accessible miscibility window, has become possible by modifying the architecture of the flexible polymer, so as to induce favorable intermolecular hydrogen bonding. Specifically, liquid crystalline polyurethanes (LCPU) are found to be miscible with a copolymer of styrene and vinyl phenol; with optimum hydrogen bonding between the carbonyl groups of the urethane linkages and the hydroxyl groups present in the styrenic matrix. Availability of a truly miscible molecular composite presents a unique opportunity of studying the conformation of polymer chains containing rigid-rods that are uniformly dispersed in a flexible coil matrix. A system consisting of the LCPU and the deuterated styrenic copolymer containing 20% vinyl phenol is examined by Small Angle Neutron Scattering at the National Center for Neutron Research at Gaithersburg and Technology, and the Institute of Solid State Research (IFF) at Jülich. Scattering curves for neat dPS-VPh did not fit the Debye-Bueche model; indicating complex structure. A two correlation length Debye-Bueche model was considered to accommodate for this nonlinear behavior. This model utilizes four fitting parameters, including two correlation lengths $a_1$ and $a_2$, corresponding to a Debye-Bueche model and Guinier model.

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