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Thermodynamics of Polymer Blends Organized by Balanced Block Copolymer Surfactants Studied by Mean-field Theories and Scattering MEGAN RUEGG, BENEDICT REYNOLDS, University of California, Berkeley, NITASH BALSARA, University of California, Berkeley, Lawrence Berkeley National Laboratory, TIMOTHY SHAFFER, MIN LIN, DAVID LOHSE, ExxonMobil Research and Engineering — The phase behavior of multicomponent blends of two immiscible homopolymers (A,B) and an A-C diblock copolymer was studied by scattering experiments and mean field theories. The interactions between the components were tuned to create organized blends with the copolymer serving as a surfactant. The morphology of A/B/A-C blends changed between lamellar phases, microemulsions, homogeneous phases and macrophase- separated states simply by adjusting the temperature. The experimentally determined phase transition temperatures and domain spacings were compared with calculations based on the Random Phase Approximation (RPA) and Self-Consistent Field Theory (SCFT). The only inputs into the calculations were the binary Flory-Huggins interaction parameters (chi) between the three kinds of monomers in our system, and statistical segment lengths. The domain spacing determined from theory was often within 5% of the experimental values. In a particular range of molecular weights, we find that a critical A/B blend can be organized into a periodic phase by the addition of only 5% of the diblock copolymer. To our knowledge, all previous experiments that have led to organized critical mixtures have required a significantly larger copolymer concentration.

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