

254h Rheology and Flow-Induced Structure in a Polystyrene-Polyisoprene Biocontinuous Microemulsion

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Polymer bicontinuous microemulsions are blends of immiscible polymers compatibilized with diblock copolymer resulting in an interconnected equilibrium morphology in which interpenetrating domains of the different species exist at length scales on the order of 10s of nanometers. We report rheological and in situ structural characterization of a microemulsion formed from low molecular weight polystyrene (PS) and polyisoprene (PI) and their corresponding block copolymer. Despite the fact that the constituent homopolymers are strictly Newtonian, the microemulsion exhibits substantial viscoelasticity associated with flow-induced deformation of the supramolecular organization. Step strain and oscillatory shear experiments at small and moderate strains are characterized by flow-induced deformation of the microemulsion structure, as characterized by in situ small angle x-ray scattering. Under even fairly weakly nonlinear flow conditions, the PS-PI microemulsion exhibits a flow-induced phase transition. Here, SAXS measurements conducted within the 1-2 shear plane are able to independently track the dynamics of flow-induced deformation of the microemulsion as well as the slower development and flow-induced orientation of the macroscopic phase separated morphology. Strong connections are established between the structural transitions and the time-dependent rheology.