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Shifting the Phase Boundary with Electric Fields to Jump In and Out of the Phase Diagram at Constant Temperature CONNIE B. ROTH, Dept. of Physics, Emory University, Atlanta, Georgia, USA, ANNIKA KRIISA, Dept. of Physics, Georgia State University, Atlanta, Georgia, USA — Understanding the phase behavior of polymer blends and block copolymers under the presence of electric fields is important for advanced applications containing electrodes such as organic photovoltaics and batteries, as well as for field-directed assembly and alignment of domains. We have recently demonstrated that electric fields enhance the miscibility of polystyrene (PS) / poly(vinyl methyl ether blends) (PVME) blends [J. Chem. Phys. 2014, 141, 134908], shifting the phase separation temperature Ts(E) up by 13.5 1.4 K for electric field strengths of E = 1.7 MV/m. Experimentally this effect is much larger than the traditional predictions from adding the standard electrostatic energy term for mixtures to the free energy of mixing. However, accounting for the energy penalty of dielectric interfaces between domains created during phase separation, the primary factor that drives alignment of domains, may also be responsible for the change in miscibility. Here we investigate the dynamics of repeatedly jumping the system from the one-phase to the two-phase region and demonstrate that this can be done at a constant temperature simply by turning the electric field on and off, illustrating electric-field-induced remixing in the two-phase region.

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