232a Finding Simplicity in Complexity: Scaling, Tricriticality, and Crossover in Polymer Solutions

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Generalizing a scaled universal description of phase separation in polymer solutions proposed by Benjamin Widom, we have develop a scaled representation of coexistence curves, osmotic sussceptibilities, and correlation lengths that accounts for a crossover between a regime with Ising (fluctuation-induced) asymptotic critical behavior, where the correlation length of the critical fluctuations prevails, and a mean-field tricritical regime with theta-point behavior controlled by the mesoscopic polymer chain. In particular, we have clarified a connection between traditional themodynamics of polymer solutions and de Gennes-Widom's scaling approach. The crossover theoretical description is compared with experimental data on liquid-liquid phase-equilibria and light-scattering measurements of susceptibilities and correlation lengths. In addition, we demonstrate the validity of de Gennes' prediction for the molecular-weight scaling of the critical amplitudes.