

Molecular thermodynamic analysis for thermosensitive N-isopropylacrylamide nanometer-sized gel particles in water-DMSO system

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In this study, the phase transition temperature behaviors of poly(N-isopropylacrylamide) (PNIPA) was measured in water-dimethylsulfoxide (DMSO) system by using thermo-optical analysis (TOA). To confirm the correlation between phase transition temperature of the polymer and volume transition temperature of the cross-linked polymer gel, we prepared nanometer-sized N-isopropylacrylamide (NIPA) gel particles by precipitation polymerization, and their swelling behaviors in a water-DMSO system were observed using photon correlation spectroscopy (PCS). A molecular thermodynamic model was employed to calculate interaction parameters from binary liquid-liquid equilibria (LLE) for PNIPA-water system. We combined the molecular thermodynamic model for mixing contribution with Flory-Rehner theory for elasticity contribution to describe the swelling behaviors of cross-linked NIPA gel particles. The reentrant swelling equilibria were calculated at various temperatures, and we were also able to compare to the experimental data for DMSO partitioning inside NIPA gel with model calculation using the same model parameters.