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Liquid-Gel-Liquid Transition and Shear-Thickening in Mixed Suspensions of Silica Colloid and Hyperbranched Polyethyleneimine[1]
GUANGCUI YUAN, HUAN ZHANG, CHARLES C. HAN, Institute of Chemistry, Chinese Academy of Science — The rheological property of mixed suspensions of silica colloid and hyperbranched polylethyleneimine was studied as functions of particle volume fraction, ratio of polymer to particle, and pH value. A mechanism of liquid-gel-liquid transition for this mixed system was proposed based on the amount and the conformation of polyelectrolyte bridges which were able to self-arrange with solution environments. The equilibrium adsorbed amount (C_p*) for a given volume fraction of particles is an important concentration ratio of polymer to particle denoting the transition of irreversible and reversible bridging. For mixed suspensions at equilibrium adsorbed state ($C_p \approx C_p$*), the adsorption-desorption of polymer bridges on the particles can reversibly take place, and shear thickening is observed under a steady shear flow as a result of rapid extension of bridges when the relaxation time scale of extension is shorter than that of desorption.

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