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Barrier Hopping, Viscous Flow and Kinetic Gelation in Nanoparticle-Polymer Suspensions KENNETH SCHWEIZER, YENG-LONG CHEN, VLADIMIR KOBELEV, University of Illinois at Urbana-Champaign — Ideal mode coupling theory is combined with the polymer reference interaction site model theory of structural correlations to predict depletion-induced physical gelation and elasticity of suspensions of nonadsorbing polymers and hard particles. The approach has been extended to treat the alpha relaxation process in the ultra-slow activated barrier hopping regime. The dynamic barrier is a rich function of polymer concentration, polymer-particle size asymmetry ratio and particle volume fraction. All these dependences can be collapsed on to a single master curve that is an effective power law function of a composite variable. Over a range of material parameters commonly studied experimentally the alpha relaxation time is an exponential function of colloid volume fraction and reduced polymer concentration. The theory has been applied to compute kinetic gel boundaries and the shear viscosity, and also to address the phenomenon of delayed sedimentation.

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