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Shear-induced clustering of Brownian suspensions in associative polymers at moderate Peclet number[1] JUNTAE KIM, MATTHEW HELGESON, Univ of California - Santa Barbara — The tendency for Brownian particles to cluster under shear flow is widely observed in polymer-colloid mixtures. However, the mechanics driving clustering are not well understood due to the complex coupling of non-Newtonian polymer rheology with colloidal hydrodynamics and Brownian motion. To better elucidate this coupling, we have developed a novel class of thermoresponsive polymer-colloid mixtures based on nanoemulsions suspended in associative polymer solutions. These fluids form associative polymer networks whose viscoelastic relaxation time can be varied by many orders of magnitude over a small temperature window, while keeping the Brownian relaxation time of the suspension relatively fixed. Combining this model system with novel rheo-small angle neutron scattering (rheo-SANS) measurements allows us to identify the mechanisms of shear-induced clustering, and how they vary in different dynamical regimes of fluid behavior. In particular, the ability to probe the full 3D microstructure of the fluid identifies features of shear-induced clusters, both during their formation and at steady state, that were inaccessible in previous studies. These features reveal that hydrodynamic effects dominate the clustering process over a wide range of conditions, and provide guidelines for controlling shear-induced clustering in polymeric fluids.

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