186h Thixotropy and Shear-Induced Microstructure of Shear-Thickening, Nanoaggregate, Fumed Silica Dispersions

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The rheology of polymeric suspensions of fumed silica particles of varying volume fraction, sizes, and surface modifications are examined. Fumed silica particles are often described as aggregated, fractal-like structures. These suspensions are shown to exhibit discontinuous shear thickening at much lower particle loadings than comparable suspensions of hard, spherical particles. For example, discontinuous shear thickening was observed for a suspension (fumed silica in polyethylene glycol) with a particle loading of only 7% by volume as opposed to the typical 52% loading required for larger (450 nm) particles. In this work, the mechanism and underlying structure of fumed silica particle dispersions are explored by rheology, microscopy, and light & neutron scattering. Thixotropy is also examined and compared to results reported in the literature. The results are compared to previous results for shear thickening in near hard sphere suspensions to establish the mechanisms of shear thickening.