217b Inducing a Sol-Gel Transition in Clay Suspensions Using Added Nanoparticles

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The addition of charged nanoparticles to a stable solution of spherical colloidal particles can produce an attractive depletion force of significant magnitude to cause flocculation of the larger, colloidal particles. In this study, we investigated how such nanoparticles would influence the behavior of a suspension of nonspherical particles, specifically disk-like clay particles. We find that the addition of both silica nanoparticles (sizes ranging from 7 to 22 nm) and salt (NaCl) to solutions of the natural clay kaolinite can actually cause a transition from a liquid to solid-like gel. Surprising, this transition only occurs when both the nanoparticles and salt are above a critical concentration, allowing the construction of a simple phase diagram. Freeze-fraction SEM images of the gel-like material indicate that the nanoparticles produce a porous, honeycomb-like arrangement of the clay disks. Evidence of stacking of the clay particles was also observed.

It is a pleasure to present this work in honor of Professor John Anderson, whose advice and suggestions have always been of tremendous help.