Pursuing Stability in Aqueous Blends of Micro- and Nanoscale Colloidal Spheres

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Aqueous binary dispersions of small soft and large hard colloidal spheres can provide an environmentally friendly vehicle for forming mechanically tough, crack-free latex films when the blend microstructure is tuned to avoid hard-particle percolation during drying. Recent work by Lewis and colleagues [1] exemplifies one applicable microstructure, where highly charged nanoparticles group into adsorbed layers around nearly-neutral microspheres and cause an unusual, complex phase behavior. We employ Monte Carlo simulations and evaluate rigorous virial expansions first to explicate the equilibrium adsorption and then to study the distribution of nanoparticles in the gap between two approaching microspheres. The latter yields the potential of mean force between the microspheres due to interactions with the nanoparticles and permits estimates of phase behavior and mechanical properties of these highly asymmetric dispersions.

[1] V. Tohver et al., *Langmuir* 17 (26), 8414 (2001).