

**Particle pressure and phase migration in suspensions:
An osmotic approach**

Jeffrey F. Morris
Levich Institute and Chemical Engineering
City College of New York
morris@ccny.cuny.edu

Suspensions of solid particles in liquids flowing at low Reynolds number provide a useful setting for development of continuum description of particle-laden fluids. This work will describe the rheology of concentrated suspensions and its implications in continuum description of the bulk flow of the mixture. The development will focus on colloidal suspensions where Brownian motion is relevant, with the limit of strong shear taken to describe noncolloidal suspensions. Of particular interest is to develop a basic microstructural picture for the basis of non-Newtonian rheology of suspensions, including the normal stress response. The normal stress proves to be critical to description of the migration of the particles, leading to strong concentration gradients. The normal stress differences as well as the isotropic normal stress of the particle phase, the “particle pressure” or nonequilibrium osmotic pressure, will be described and related to these migration phenomena; the normal stresses will be shown to both be measurable by an experiment based on the semi-permeable membrane concept used to measure osmotic pressure, and to be accessible by discrete-particle Stokesian Dynamics simulations. Results of bulk flow modeling under conditions where migration is observed will be presented.