FM16S_12452

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Single Particle Motion in Colloidal Dispersions

Ileana C. Carpen, Todd M. Squires, John F. Brady

California Institute of Technology, Pasadena, USA

The motion of a particle of size a due to an imposed external force through a suspension of colloidal particles is investigated analytically and numerically. The particle's translational velocity is determined by a balance between the imposed force and the reactive force of the colloidal dispersion, which consists of the viscous Stokes drag and a Brownian force caused by the microstructural deformation. The Peclet number (Pe = Fa/ kT), the ratio of the external force (F) to the Brownian force (kT/a), governs the distortion of the microstructure. At small Pe the response is viscous, with a linear relation between the imposed force and the particle velocity. As the Peclet number is increased the particle's velocity decreases with increasing Pe until a viscous plateau is reached at infinite Pe. This 'shear thinning' of the particle's velocity is reminiscent of the shear thinning of the dispersion's viscosity.

View the extended summary