Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Normal stresses in non-Brownian suspensions: bulk rheology and particle migration FRANCOIS BOYER, OLIVIER POULIQUEN, ELISABETH GUAZZELLI, IUSTI, CNRS - Aix-Marseille Universite — Concentrated suspensions are known to exhibit non-Newtonian effects and classical rheology often fails to give a consistent description of actual flows. Particle migration has been shown to be the main reason for both thixotropic effects and inhomogeneous microstructure of sheared suspensions, and is thus of primary interest for applications. The suspension balance model relates the particle migration to the suspension normal stresses and is therefore a consistent set of constitutive equations. Recently, this model has been revisited and other mechanisms have been proposed. In that context, an experimental study that characterize both normal stresses and particle migration independently is of great interest. We report measurements of normal stress differences in concentrated suspensions of non-Brownian spheres thanks to a rotating-rod rheometer. Normal stresses are experimentally shown to vanish below a critical volume fraction of 0.22: this could therefore indicate a non-hydrodynamic origin of macroscopic normal stresses. Furthermore, the time-dependent behaviour of the system is the signature of particle migration: comparisons with theoretical predictions allows to test quantitatively particle migration models.

Elisabeth Guazzelli
IUSTI, CNRS - Aix-Marseille Universite

Date submitted: 13 Oct 2010 Electronic form version 1.4