Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

The Sedimentation of Particles under Orthogonal Shear in Viscoelastic Fluids[1] WILLIAM L. MURCH, SREENATH KRISHNAN, ERIC S. G. SHAQFEH, Stanford University — Many engineering applications, including oil and gas recovery, require the suspension of particles in viscoelastic fluids during fluid transport and processing. A topic of specific importance involves such particle suspensions experiencing an applied shear flow in a direction perpendicular to gravity (referred to as orthogonal shear). Previously, it has been shown that particle sedimentation coupled with an orthogonal shear flow can reduce the particle settling rate in elastic fluids. The underlying mechanism of this enhanced coupling drag is not fully understood, particularly at finite Weissenberg numbers. This talk examines the role of fluid elasticity on a single, non-Brownian, rigid sphere settling in orthogonal shear using experiments and numerical simulations. New experiments were performed in a Taylor-Couette flow cell using Boger fluids to study the coupling drag as a function of the shear and sedimentation Weissenberg numbers as well as particle confinement. The elastic effect was also studied with fully 3D simulations of flow past a rigid sphere, using the FENE-P constitutive model to describe the polymeric fluid rheology. These simulations show good agreement with the experiments and allow for further insight into the mechanism of elasticity-enhanced drag.

[1]This material is based upon work supported by the National Science Foundation Graduate Research Fellowship.

William L. Murch
Stanford University

Date submitted: 31 Jul 2016 Electronic form version 1.4