Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Effect on Non-Newtonian Rheology on Mixing in Taylor-Couette Flow NEIL CAGNEY, STAVROULA BALABANI, University College London — Mixing processes within many industry applications are strongly affected by the rheology of the working fluid. This is particularly relevant for pharmaceutical, food and waste treatment industries, where the working fluids are often strongly non-Newtonian, and significant variations in rheology between batches may occur. We approach the question of how rheology affects mixing by focussing on a the classical case of Taylor-Couette flow, which exhibits a number of instabilities and flow regimes as a function of Reynolds number. We examine Taylor-Couette flow generated for a range of aqueous solutions of xantham gum or corn starch, such that the rheology varies from shear-thinning to shear-thickening. For each case, we measure the power consumption using a torque meter and the flow field using high speed, time-resolved Particle-Image Velocimetry. The mixing characteristics are quantified using a number of Lagrangian and Eulerian approaches, including the coarse grained density method and vortex strength. By comparing these metrics to the power number, we discuss how the mixing efficiency (ratio of mixing effectiveness to power input) varies with the flow index of the fluid.

Neil Cagney
University College London

Date submitted: 31 Jul 2017 Electronic form version 1.4