Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Stretching dense colloidal suspensions: from flow to fracture MICHAEL SMITH, University of Nottingham, RUT BESSELING, ANDREW SCHOFIELD, University of Edinburgh, JAMES SHARP, University of Nottingham, MIKE CATES, University of Edinburgh, VOLFANGO BERTOLA, University of Liverpool — Concentrated suspensions of particles are commonly used in the pharmaceutical, cosmetic and food industries. Manufacture of these products often involves flow geometries that are substantially different from those studied by conventional shear rheology. Using a capillary break-up extensional rheometer we stretch fluids of different volume fraction at strain rates just below, at and above the critical rate required to induce jamming. We show that the jamming of a stretched colloidal column is closely related to that observed during shear rheology. However, fascinating additional effects due to the geometry are also observed. High speed photography of the filament shows evidence of dilatancy and granulation, leading finally to fracture at a critical strain rate. We also investigate an intriguing aspect of thin fluid filaments of the colloidal suspension, when stretched below the critical strain rate required to produce jamming. These filaments are observed to thin to a critical diameter before rupturing and displaying visco-elastic recoil. Finally, using fluorescent particles we visualise the flow fields inside these filaments to understand the dynamics.

Michael Smith
University of Nottingham

Date submitted: 08 Nov 2011 Electronic form version 1.4