Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Deformation and breakup of viscoelastic droplets in confined shear flow[1] MAURO SBRAGAGLIA, ANUPAM GUPTA, University of Rome "Tor Vergata" — The deformation and breakup of Newtonian/viscoelastic droplets in systems with a Newtonian matrix are studied in confined shear flow. Our numerical approach is based on a combination of Lattice-Boltzmann models (LBM) and Finite Difference (FD) schemes, the former used to model two immiscible fluids with variable viscous ratio, and the latter used to model the polymer dynamics. The kinetics of the polymers is introduced using constitutive equations for viscoelastic fluids with finitely extensible non-linear elastic dumbbells with Peterlin's closure (FENE-P). We quantify the droplet response by changing the polymer relaxation time, the maximum extensibility of the polymers, and the degree of confinement, i.e. the ratio of droplet diameter to gap spacing. In bulk shear flow, the effects of droplet viscoelasticity on the critical capillary number for breakup are moderate in all cases studied. However, in confined conditions a different behaviour is observed: the critical capillary number of a viscoelastic droplet increases or decreases, depending on the maximum elongation of the polymers, the latter affecting the extensional viscosity of the polymeric solution. Force balance is monitored in the numerical simulations to validate the physical picture.

[1]ERC Grant Agreement n.279004

Mauro Sbragaglia
University of Rome "Tor Vergata"

Date submitted: 18 Jul 2014 Electronic form version 1.4