Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Suspensions with a tunable effective viscosity[1] PHILIPPE PEYLA, SALIMA RAFAI, Grenoble University, France, LEVAN JIBUTI, Bayreuth University, Germany — In this work, we conduct a numerical investigation on sheared suspensions of non-colloidal spherical particles on which a torque is applied. Particles are mono-dispersed and neutrally buoyant. Since the torque modifies particles rotation, we show that it can indeed strongly change the effective viscosity of semi-dilute or even more concentrated suspensions. We performed our calculations up to a volume fraction of 0.28. And we compare our results to data obtained at 0.40 by other authors with a totally different numerical method. Depending on the torque orientation, one can increase (decrease) the rotation of the particles. This results in a strong enhancement (reduction) of the effective shear-viscosity of the suspension. We construct a dimensionless number Q which represents the average relative angular velocity of the particles divided by the vorticity of the fluid generated by the shear flow. We show that the contribution of the particles to the effective viscosity can be suppressed for a given and unique value of Q independently of the volume fraction. In addition, we obtain a universal behavior (independent of the volume fraction) when we plot the relative effective viscosity divided by the relative effective viscosity without torque as a function of Q. Finally, we show that a modified Faxen law can be equivalently established for large concentration.

[1]We thank the ANR MOSICOB and MICMACSWIM.

Philippe Peyla
Grenoble University, France

Date submitted: 11 Jul 2012 Electronic form version 1.4