Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Shear thinning rheology in concentrated suspension of fibers modeled using a load depended friction coefficient[1] MONSURUL KHAN, RISHABH V. MORE, Purdue University, West Lafayette, USA, ARASH ALIZAD BANAEI, LUCA BRANDT, Linn Flow Centre and SeRC (Swedish e-Science Research Centre), KTH Mechanics, Sweden, AREZOO M. ARDEKANI, Purdue University, West Lafayette — Study of rheology of suspensions of fibers is essential in many industrial applications such as paper and pulp production, biofuel production and material reinforcement. Rheological properties of dense suspensions such as viscosity and normal stress coefficients depend on a large number of parameters such as fiber aspect ratio, volume fraction, flexibility of the fiber, roughness, and friction between fibers. As the solid volume fraction increases, the contribution from the contact force to viscosity becomes more important compared to the hydrodynamic force. We perform direct numerical simulations modeling the fibers as continuous flexible slender bodies governed by the Euler-Bernoulli beam theory. An immersed boundary method is used to solve for the motion of fibers and couple it with the Navier-Stokes equations for the fluid. To model the contact between fibers a normal load dependent coefficient of friction is used which successfully recovers the shear thinning behavior in suspensions observed in experiments. After validating our computational model, we perform a parametric study varying fiber flexibility, volume fraction and examine suspension viscosity and yield stress.

[1]Department of Energy, Award No - EE0008256

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Date submitted: 01 Aug 2020 Electronic form version 1.4