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**The effect of particle shape and particle-polymer interactions on the extensional rheology of filled polymeric fluids**[1] ARJUN SHARMA, Graduate Student, Sibley School of Mechanical and Aerospace Engineering, Cornell University, Ithaca, NY, 14853, USA, DONALD KOCH, Professor, Robert Frederick Smith School of Chemical and Biomolecular Engineering, Cornell University, Ithaca, NY 14853, USA — The addition of particles greatly alters the stresses in a polymeric fluid undergoing strong extensional flow. We investigate the extensional rheology of a suspension of prolate spheroids in such fluids using a perturbation expansion in small polymer concentration, the generalized reciprocal theorem, and ensemble-averaged equations. The method of characteristics is applied to numerically evaluate the particle-polymer interaction based on FENE-P constitutive equations. The polymers influence the particle stresslet through the surface stress and the particles influence the polymer stretch through velocity perturbations. The variation of extensional rheology with the particle shape is obtained analytically for a second-order fluid. The limiting cases of the small and large aspect ratio of the particles are understood in terms of previous results for spherical fillers and newly derived results based on slender body theory. The particle-polymer interaction stress varies non-monotonically with the extension rate. It is positive at small extension rates when the undisturbed polymers are coiled, but is negative when they are fully stretched at larger rates. The kinematics of the velocity field provide further physical insight into polymer stretching and the resulting stresses.

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Arjun Sharma
Cornell University

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