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Effects of inertia on the rheology of a dilute emulsion of drops in steady shear XIAOYI LI, KAUSIK SARKAR, University of Delaware — Effects of inertia on the rheology of a dilute Newtonian emulsion are investigated using DNS. The drop shape and flow are computed by solving the Navier-Stokes equation in two phases using Front-tracking method at nonzero Reynolds numbers of 0.1 and 1.0. Effective stresses are computed using Batchelor's formulation, where the interfacial stress is obtained from the simulated drop shape and the perturbation stress from the velocity field. At low Reynolds number, the simulation is compared successfully with various analytical results and experimental measurements. At higher inertia deformation is enhanced and the tilt angle of the drop becomes larger than forty-five degree. The inertial morphology directly affects interfacial stresses. The first and the second interfacial normal stress differences are found to change sign due to the change in drop orientation. The interfacial shear stress is enhanced by inertia and decreases with capillary number at lower inertia but increases at higher inertia. The total excess stresses including perturbation stress contribution shows similar patterns.

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