Abstract Submitted
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Steady-state flow properties of amorphous materials[1] VIKRAM JADHAO, THOMAS O'CONNOR, MARK ROBBINS, Johns Hopkins University — Molecular dynamics (MD) simulations are used to investigate the steady-state shear flow curves of a standard glass model: the bidisperse Lennard-Jones system. For a wide range of temperatures in the neighborhood of the glass transition temperature $T_{\rm g}$ predicted by the mode coupling theory, we compute the steady-state shear stress and viscosity as a function of the shear rate $\dot{\gamma}$. At temperatures near and above $T_{\rm g}$, the stress crosses over from linear Newtonian behavior at low rates to power law shear-thinning at high rates. As T decreases below $T_{\rm g}$, the stress shows a plateau, becoming nearly rate-independent at low $\dot{\gamma}$. There is a weak increase in stress that is consistent with Eyring theory for activated flow of a solid. We find that when the strain rate is reduced to extremely low values, Newtonian behavior appears once more. Insights gained from these simulations are applied to the computation of flow curves of a well-established boundary lubricant: squalane. In the elastohydrodynamic regime, squalane responds like a glassy solid with an Eyring-like response, but at low rates it has a relatively small Newtonian viscosity.

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