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Molecular dynamics simulations of the shear-rate-dependent slip length in thin liquid films NIKOLAI PRIEZJEV, ANOOSHEH NIAVARANI, Michigan State University, Dept. Mechanical Engineering — The dynamic behavior of the slip length in the flow of simple and polymeric fluids confined between atomically smooth surfaces is investigated using molecular dynamics simulations. At weak wall-fluid interactions, the slip length increases nonlinearly with the shear rate provided that the interface between simple fluid and rigid solid forms incommensurable structures. A gradual transition to approximately linear rate- dependence is observed upon increasing the wall-fluid interaction. A pronounced upward curvature in the shear rate dependence of the slip length is reported for the shear flow of the polymer melt. We found that the slip length can be well described by a function of a single variable, which is a combination of the in-plane structure factor, contact density and temperature of the first fluid layer near the solid wall. Extensive simulations show that this scaling holds in a wide range of shear rates and wall-fluid interactions for both simple fluids and short polymer chains. A relation to recent slip flow experiments is discussed. Reference: N.V. Priezjev, "Rate-dependent slip boundary conditions for simple fluids," Phys. Rev. E 75, 051605 (2007).

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