Abstract Submitted
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Effect of surface roughness on rate-dependent slip in simple fluids.[1] NIKOLAI PRIEZJEV, Michigan State University, Dept. Mechanical Engineering — The influence of molecular-scale surface roughness on the slip length in a flow of simple fluids is investigated using molecular dynamics simulations. The parabolic fit of the steady state velocity profiles induced by a constant force is used to define the value of interfacial shear rate. At weak wall-fluid interactions, the slip length increases non-linearly with the shear rate provided that the liquid/solid interface forms incommensurable structures. A gradual transition to the linear rate-dependence is observed upon increasing the wall-fluid interaction. Thermal surface roughness is found to affect the slip behavior significantly: for soft walls the slip length weakly depends on the shear rate. With increasing elastic stiffness of the wall, the linear rate-dependence of the slip length is restored again. Periodically and randomly corrugated surfaces strongly suppress both the magnitude and slope of the rate-dependence of the slip length even for weak wall-fluid interactions. A relation to recent slip flow experiments is discussed.

[1]N.V. Priezjev and S.M. Troian, J. Fluid Mech., 554, 25 (2006).

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