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Source of Shear Dependent Slip at Liquid/Solid Interfaces NIKOLAI PRIEZJEV[1], SANDRA TROIAN, School of Engineering and Applied Science, Princeton University — Slippage at liquid/solid interfaces can strongly influence transport behavior in micro- and nanoscale systems. Previous molecular dynamics (MD) studies of simple and polymeric fluids subject to planar shear at small Reynolds number have shown that the slip length increases as a power law in the shear rate for moderate to high values. The corresponding boundary condition provides a new generalization of the Navier slip law. In this talk, we examine what physical mechanism is responsible for the shear rate exponent by focusing on the collision events between the fluid particles in the first layer and the adjacent wall particles comprising a crystalline surface. By examining the interfacial frictional force as a function of the fluid sliding velocity, we recover similar behavior as inherent in the generalized slip condition and determine that the dominant frictional response stems from the repulsive part of the Lennard-Jones interaction potential. A reduced kinetic model describing the scattering of a single molecule with a given slip velocity along a crystalline surface helps explain the saturation in the frictional force at large sliding velocities. These results elucidate how different is the slip behavior at liquid/solid interfaces from that observed in rarefied gases.

[1]Current address: Dept of Mechanical Eng., Michigan State Univ.

Sandra Troian
Princeton University

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