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Atomistic effects on friction and contact area in single and multi asperity contacts[1] BINQUAN LUAN, Dept. of Physics, Univ. of Illinois at Urbana-Champaign, MARK ROBBINS, Dept. of Physics and Astronomy, Johns Hopkins University — Contact and friction are universal phenomena in our daily life. Theoretical studies of macroscopic contact and friction are usually based on continuum theories such as Hertz theory and Amontons's laws. Recent advances in nanotechnology have stimulated research into friction at the nanometer scale where new phenomena emerge. Contact and friction in single- and multi-asperity contacts with nanometer dimensions were studied using molecular dynamics simulations (MD) and a hybrid method. The hybrid method retains a full atomistic treatment near contacts and replaces more distant regions with a more efficient finite element description. Our results demonstrate that atomic-scale changes in surface structure produce huge changes in friction and contact area and substantial deviations from the predictions of continuum theories. Unanticipated surface plasticity is observed near peaks on crystalline surfaces. In the case of multiasperity amorphous systems, the rate of local plastic deformation near the surface is directly related to the frictional dissipation of energy.

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