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Scaling laws in superlubric sliding of metallic nanoparticles MICHAEL FELDMANN, DIRK DIETZEL, TRISTAN MOENNINGHOFF, AN-DRE SCHIRMEISEN, Institute of Physics and Center for Nanotechnology, University of Muenster, Germany, UDO D. SCHWARZ, Department of Mechanical Engineering, Yale University, New Haven, CT, USA — If an interface between two incommensurate surfaces is atomically clean, a state of virtually frictionless sliding is anticipated, often referred to as "superlubricity." Theory predicts that the lattice mismatch at the interface causes a decrease of shear stress with increasing contact area, ultimately leading to vanishing friction. Analyzing the contact area dependence of superlubric friction should therefore confirm the concept of superlubricity. To measure the interfacial friction we have manipulated metallic nanoparticles of different size on atomically flat surfaces by contact mode atomic force microscopy techniques. An optimized experimental setup allowed us to quantify friction of nanoparticles which previously appeared to be sliding frictionless [1]. As theoretically expected, interfacial friction showed a nonlinear contact area dependence with a shear stress decreasing with contact area. This confirms the superlubric sliding of the nanoparticles under investigation.

[1] Dietzel et al., Phys. Rev. Lett. 101, 125505 (2008).

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