O 57: Nanotribology

Time: Wednesday 16:30–17:00 Location: WIL C307

O 57.1 Wed 16:30 WIL C307

Driven colloidal monolayers on periodic and quasiperiodic substrate potentials as model systems for nanotribology —
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Tribology - the science of interacting surfaces in relative motion - is of great importance for all technical applications where moving bodies are in contact. Experimental tools such as the friction force microscope enable the investigation of frictional processes at atomic scales. Here we present a study which allows to probe friction on the micrometer range. We experimentally study the sliding behavior of a two dimensional colloidal crystal interacting with periodic and quasiperiodic light induced substrate potentials created by overlapping several laser beams. Translations of the sample cell correspond to applying a lateral force on the crystal in any desired direction. The crystal's response is then studied in real space by digital video microscopy. We observe high friction for periodic commensurate systems, whereas for periodic incommensurate and quasiperiodic systems the static friction force almost vanishes, giving rise to superlubric sliding states. In a final step, we examine the effect of phononic and phasonic excitations of the quasiperiodic substrate potential on the sliding friction.

O 57.2 Wed 16:45 WIL C307

Frictional duality of metallic nanoparticles: Influence of particle morphology, orientation, and air exposure —
•Dirk Dietzel[1], Michael Feldmann[1], Udo D. Schwarz[2], Ivan Stich[3], Jan Brndiar[3], and Andre Schirmeisen[1] — [1]Institute of Physics and Center for Nanotechnology, University of Muenster — [2]Department of Mech. Engineering, Yale University, New Haven, USA — [3]Institute of Physics, Slovak Academy of Sciences,Bratislava

The contact area dependence of the interfacial friction experienced during the translation of Sb nanoparticles deposited on a graphite substrate is studied under different conditions using the tip of an atomic force microscope as manipulation tool. In vacuum a dual behavior of the friction-area curves is found, characterized by the observation that some particles exhibit friction below the detection limit while other similarly sized particles showed constant shear stress. Detailed investigations prove the reproducibility of this effect, revealing that neither the particle's morphology nor their alignment relative to the substrate lattice influence the findings [1]. In contrast, we observe that temporary exposure to ambient air can lead to a drastic increase in the particle's friction. This finding highlights the strong effect of interface contamination, which is also considered the reason for the frictional duality observed in UHV. To further elucidate the contamination mechanisms, simulations by DFT modelling have been performed for different kinds of conceivable contaminants. These simulations help to get a grasp on the degree and nature of the interface contamination affecting the experiments. [1] Dietzel et al. Phys. Rev. B. 82, 035401 (2010)