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Nanoscale friction at the solid-liquid interface: in-situ force microscopy of complex layers

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Friction at the solid-liquid interface depends on the structure of the molecular layers which define the shear plane. We report results of in-situ friction force experiments which reveal effects of the surface structure and of the applied electrochemical potential on nanoscale friction. An ordered layering of hydrocarbon lubricant molecules was found even on technical surfaces [1], this layer is stabilized by single layers of graphene on steel surfaces [2]. For ionic liquids, we found a potential-induced crystallization of the confined liquid by means of an AFM based nano-rheology [3]. On a metallic glasse, electrochemical oxidation takes the form of a stable inner and a softer outer layer with nanometer thickness. The latter precipitates from metal oxides and hydroxides. It contributes to nanoscale friction but is removed upon repeated sliding [4]. The strong interest in hydrogels as biomaterials has also prompted us to investigate the nanomechanics of their surfaces by means of force spectroscopy at the single-molecule scale [5].

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