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Physisorbed molecules: How their frictional and diffusive properties impact lubricity[1]

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Friction and its consequences are of great concern from both a national security and quality-of-life point of view, and the economic impact of energy efficiency, wear, and manufacturing cannot be underestimated [1]. Lubrication schemes for many macroscopic applications have been solved, but an era of science and engineering is emerging where control of mechanical and electrical systems at the atomic level will be required [2]. A fundamental understanding of the dissipative and frictional properties of weakly adsorbed films, which are ubiquitous in these systems, is key to a vast range of emerging applications. This talk will begin with a discussion of how diffusive and frictional properties of adsorbed atoms and molecules governed by van der Waals interactions can be measured experimentally [3]. Selected example of how atomic scale mobility in physisorbed materials, even at very low coverage, can directly impact friction, tribological performance and/or device viability will then be presented, for systems spanning Micro- and Nano- ElectroMechanical Systems to avalanches in granular materials [4,5].

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[2] "QCM tribology studies of thin adsorbed films", J. Krim, Nano Today 2 (5): 38-43, (2007)

[3] "Sliding friction measurements of molecularly thin ethanol and pentanol films: How friction and spreading impact lubricity", B.P. Miller and J. Krim, J. Low. Temp. Phys., **157,** Special issue on Wetting, Spreading, and Filling, p 252 (2009)

[4] "Friction, Force Chains and Falling Fruit ", J. Krim and R.P. Behringer, Physics Today, **62,** pp. 66-67 (Sept. 2009)

[5] "Atomic-scale lubrication at ultra-low vapor coverages", D.A. Hook, B.P. Miller, B.M. Vlastakis, M.T. Dugger and J. Krim, submitted

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