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Contribution of Plowing to Nanotribology of Self-Assembled Monolayers MICHAEL CHANDROSS, Sandia National Laboratories, CHRISTIAN LORENZ, Kings College, London, GARY GREST, Sandia National Laboratories, ERIN FLATER, Luther College, ROBERT CARPICK, University of Pennsylvania — Atomic force microscope experiments and molecular dynamics (MD) simulations on self-assembled monolayer (SAM) systems have demonstrated that the nanotribology of these systems may be dominated by a microscopic plowing mechanism. Due to relatively weak chain-to-chain interactions, compression only affects molecules directly under the probe tip, and not those outside the contact area. Under shear, the tip must plow into the molecules in front leading to frictional energy dissipation. We will present the results of coupled experiments and MD simulations of alkylsilane SAMs studying the plowing mechanism in detail. In particular, combinations of uncoated and SAM-coated substrates and tips are studied to probe the relationships between friction force and both contact area and applied load. As a SAM coating on the substrate (tip) is (is not) expected to result in plowing during shear, the contrast in these results, combined with detailed calculations using the MD results, will shed light on the complicated response of these systems. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under Contract No. DE-AC04-94AL85000.

Michael Chandross
Sandia National Laboratories

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