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A nanotribology study of self-mated *vs.* unmated interfaces and local packing density effects for octadecyltrichlorosilane monolayers and silicon ERIN FLATER, Luther College, W. ROBERT ASHURST, Auburn University, ROBERT CARPICK, University of Pennsylvania — We use atomic force microscopy (AFM) to determine the frictional properties of nanoscale single asperity contacts involving octadecyltrichlorosilane (OTS) monolayers and silicon. Quantitative AFM measurements are performed using both uncoated and OTS-coated silicon AFM tips and surfaces. Friction is reduced by the presence of the OTS coating, and the overall shape of the friction *vs.* load plot strikingly depends on whether or not the substrate is coated with OTS, regardless of tip material. Uncoated substrates exhibit the common sublinear dependence, while coated substrates exhibit an unusual superlinear dependence. These results can be explained qualitatively by invoking molecular plowing as a significant contribution the frictional behavior of OTS. Direct *in-situ* comparison of two intrinsic OTS structural phases of otherwise identical molecules on the substrate show that the lower packing density phase exhibits higher friction, decisively observed here in single, uninterrupted images on the same monolayer for the first time. The lateral stiffness of the two OTS structural phases are indistinguishable, which implies that the packing density directly affects the interface's intrinsic resistance to shear as opposed to simply modifying the stiffness of the monolayer.

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