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The effect of packing density on self-assembled monolayer friction: Investigation of frictional contrast between OTS phase-separated regions ERIN FLATER, University of Wisconsin - Madison — Motivated by the lack of fundamental understanding of friction, and that friction and wear are major limiting factors for surface micromachined devices, we use atomic force microscopy (AFM) to determine the nanoscale frictional properties of alkylsilane monolayers commonly used in these microscale devices to reduce adhesion and friction. Quantitative nanoscale single asperity measurements of friction and contact stiffness are performed using monolayer-terminated AFM tips on monolayer-terminated silicon. By comparing the two structural phases present in octadecyltrichrolosilane (OTS) monolayers, we observe that friction depends on the local molecular packing density. The liquid condensed phase shows measurably lower friction at low loads than the liquid expanded phase, demonstrating that lower friction is associated with higher molecular packing density. However, the phases exhibit the same frictional response at higher loads, suggesting that compressed forms of both phases are structurally and tribologically equivalent. We discuss these results in terms of stress-induced molecular conformational changes in the confined interface. We acknowledge our collaborators: W. Robert Ashurst at Auburn University, who provided the OTS samples, and Maarten P. de Boer and Alex D. Corwin at Sandia National Laboratories.

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