Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Lubricant retention in liquid-infused microgrooves exposed to turbulent flow[1] MATTHEW FU, TING-HSUAN CHEN, CRAIG ARNOLD, MARCUS HULTMARK, Princeton University — Liquid infused surfaces are a promising method of passive drag reduction for turbulent flows. These surfaces rely on functionalized roughness elements to trap a liquid lubricant that is immiscible with external fluids. The presence of the lubricant creates a collection of fluid-fluid interfaces which can support a finite slip velocity at the effective surface. Generating a streamwise slip at the surface has been demonstrated as an effective mechanism for drag reduction; however, sustained drag reduction is predicated on the retention of the lubricating layer. Here, a turbulent channel-flow facility is used to characterize the robustness of liquid-infused surfaces and evaluate criteria for ensuring retention of the lubricant. Microscale grooved surfaces infused with alkane lubricants are mounted flush in the channel and exposed to turbulent flows. The retention of lubricants and pressure drop are monitored to characterize the effects of surface geometry and lubricant properties. To improve the retention of lubricant within grooved structures, a novel laser patterning technique is used to scribe chemical barriers onto grooved surfaces and evaluated.

[1]Supported under ONR Grants N00014-12-1-0875 and N00014-12-1-0962 (program manager Ki-Han Kim) and by the Department of Defense (DoD) through the National Defense Science Engineering Graduate Fellowship (NDSEG) Program

Matthew Fu
Princeton University

Date submitted: 01 Aug 2017 Electronic form version 1.4