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Flow-driven failure of liquid-filled surfaces IAN JACOBI, JASON WEXLER, HOWARD STONE, Princeton University — A micro-patterned surface impregnated with liquid is subjected to laminar shear flow and the subsequent drainage of the liquid is measured. Such lubricant-infused rough surfaces offer a promising new approach to drag reduction by providing surface slip between the mobile lubricant within the roughness and the outer flow in a manner that is more stable and robust than traditional air-layer-based super-hydrophobic surfaces. We consider the effect of roughness geometry and lubricant properties on the drainage behavior of liquid-infused surfaces in order to understand the physical mechanisms of liquid drainage and the failure modes of such drag-reducing surfaces at the micro-scale. The analysis of micro-scale drainage is then used to develop design criteria for enhanced lubricant retention and drag reduction under a variety of shear flow conditions.

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