Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Velocimetry of aqueous foam drainage MATTHEW J. KENNEDY[1], JAMES W. FLEMING, Naval Research Laboratory — We study the flow behavior of a freely draining aqueous foam using microparticle image velocimetry. Video shows liquid traveling uphill along the bubble surfaces, counter-directional to the primary flow. Most theoretical models of foam drainage avoid direct calculation of the flow at the gas-liquid interface. Rather, they treat the effect of surface flow empirically due to lack of experimental and theoretical understanding of the forces which cause flow at the surface. This uphill flow represents a significant component of the overall flow. Understanding the surface-driven flow can improve predictions of water-retention time. In the present work, we use a proprietary fire-suppression foam solution comprising hydrocarbon-based non-fluorinated surfactants in water. At the start of drainage, the mean upward flow speed is 0.2 ± 0.1 mm/s while the mean downward flow speed is 0.8 ± 0.1 mm/s. The local bubble size at the location-under-imaging is 0.6 mm with a coefficient of variation of 50%. Ongoing efforts concern the effect of the liquid solution constituents on the uphill flow and the effect of bubble size on drainage time.

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Date submitted: 29 Jul 2011 Electronic form version 1.4