Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Anti-foaming without defoaming agents A. BICK, Harvard Univ., W.D. RISTENPART, Univ. California at Davis, E. VAN NIEROP, H.A. STONE, Harvard Univ. — We study the entrainment of air bubbles as a result of multiple drop impacts on a liquid/air interface. Previous studies from the literature have focused almost exclusively on the mechanism by which a single drop impacting a flat liquid-air interface entrains an air bubble. For sufficiently small droplets at low velocities, the existing literature predicts that no air bubbles will be entrained, but we often observe air entrainment if two drops impact sequentially. We qualitatively identify different entrainment behaviors following the sequential impact of two drops, and we present experimental data quantifying the critical crater depth and the time interval between successive drops necessary to entrain bubbles. We apply this approach to 1 mm diameter drops impacting a liquid surface with speed $u \approx 1$ m/s (We ≈ 10) and find that a critical separation time $t < 5$ ms is necessary for bubble entrainment. This critical time agrees with a dimensional estimate of the time necessary for an impact crater to close owing to capillary effects. Using these ideas we demonstrate a rotating-nozzle apparatus which prevents sequential drop impacts and consequently suppresses foam formation. The key implication of this technology is the development of liquid-into-liquid dispensers that suppress foam without requiring the use of chemical defoaming agents.

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Date submitted: 31 Jul 2008 Electronic form version 1.4