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Instabilities in Bubble Pinch-Off J.C. BURTON, R. WALDREP, P. TABOREK, University of California, Irvine — When gas is released from a submerged nozzle, the bubbles must separate and pinch-off before rising to the surface. This process involves a singularity in the flow as the diameter of the neck shrinks to zero. We present high-speed videos (100,000 fps) of bubble pinch-off in a variety of fluids with viscosities ranging from .01 Poise (water) to 120 Poise (silicone oil). The forces involved in the pinch-off come from surface tension, inertia and viscous dissipation. In viscous fluids, surface tension and viscosity are balanced and the neck shrinks linearly in time to beyond optical resolution. When the viscosity of the exterior fluid is sufficiently small (i.e. water), inertia dominates the flow and the neck diameter shrinks with $\tau^{1/2}$, where τ is the time remaining until pinch-off. In the low viscosity regime, we find that the flow becomes unstable, and the neck ruptures at a typical length scale of 100 μm and a time scale of τ=10 μs. The acoustic signature of this instability will also be presented.

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