Surfactant effects on bubble pinch-off YUAN-NAN YOUNG, Dept. of Mathematical Sciences, NJIT, JIE LI, Dept. of Engineering, Cambridge University, MICHAEL SIEGEL, MICHAEL BOOTY, DEMETRIUS PAPAGEORGIOU, Dept. of Mathematical Sciences, NJIT — The effect of surfactant on the pinch-off of an inviscid bubble surrounded by a viscous fluid is studied theoretically and numerically. Equations governing the evolution of the interface and surfactant concentration in zero-Reynolds-number flow are derived using a long wavelength approximation. In the case of soluble surfactant the derivation assumes either zero bulk Peclet number Pe, or infinite Pe. Results of the long wavelength model are compared against numerical simulations of the full Navier-Stokes equations, performed using a highly accurate arbitrary Lagrangian-Eulerian method. The presence of insoluble surfactant significantly retards pinch-off: This is due to the development of a long, slender, quasi-stable cylindrical thread at the location of minimum radius, where the destabilizing influence of capillary pressure is balanced by the internal pressure. For soluble surfactant, depending on parameter values, a filament forms first but pinches off later due to the exchange between bulk and surface surfactants. We will show how the time from filament formation to pinch-off and the bubble shape at pinch-off depends on the parameters values.

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