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Bubble pinch-off in viscous liquids[1] ROCÍO BOLAÑOS-JIMÉNEZ, ALEJANDRO SEVILLA, CARLOS MARTÍNEZ-BAZÁN, Universidad de Jaen, DEVARAJ VAN DER MEER, University of Twente, JOSÉ MANUEL GORDILLO, Universidad de Sevilla — The effect of liquid viscosity on the final instants previous to pinch-off of an air bubble immersed in a stagnant viscous liquid is experimentally and theoretically investigated. Our experiments show that the use of a power-law to describe the collapse dynamics of the bubble is not appropriate in an intermediate range of liquid viscosities, for which a transition from an inviscid to a fully viscous pinch-off takes place. Instead, the instantaneous exponent $\alpha(\tau)$ varies during a single pinch-off event from the typical values of inviscid collapse, $\alpha \simeq 0.58$, to the value corresponding to a fully viscous dynamics, $\alpha \simeq 1$. However, we show that the pinch-off process can be accurately described by the use of a pair of Rayleigh-like differential equations for the time evolution of the minimum radius and the axial curvature evaluated at the minimum radius, r_1. This theoretical model is able to describe the smooth transition which takes place from inviscid to viscous-dominated pinch-off in liquids of intermediate viscosity, $10 \leq \mu \leq 100$ cP, and accounts for the fact that the axial curvature remains constant when the local Reynolds number becomes small enough, in agreement with our experimental measurements.

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