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Effect of gravity on the liquid film surrounding a bubble translating in a tube.[1] OMER ATASI, Universite Libre de Bruxelles and Princeton University, SEPIDEH KHODAPARAST, Ecole polytechnique federale de Lausanne and Princeton University, BENOIT SCHEID, Universite Libre de Bruxelles, HOWARD A. STONE, Princeton University — The motion of confined elongated bubbles in small diameter tubes filled with viscous liquid is a ubiquitous problem relevant to many industrial and medical applications such as lubrication, oil extraction and the treatment of pulmonary disorders. As a confined bubble proceeds into a liquid-filled tube a thin film of liquid is formed on the tube wall. For negligible inertia and buoyancy (Bo, $Re \simeq 0$), the thickness of this film depends only on the capillary number Ca. However, gravitational effects are not negligible for horizontal tubes of millimeter-scale diameter, corresponding to a finite Bond number Bo. We perform experiments and theoretical analysis to investigate the effect of Bo on the thin film thickness. Several values of Bo are tested experimentally by changing the tube diameter. Due to gravity, the film deposited on the upper wall of the channel is thinner than the film at the bottom wall, and the bubble is inclined toward the bottom of the tube as it translates along the tube. The inclination angle increases with increasing Bo and Ca. Our theoretical analysis shows that this effect is caused by the bubble being off-center in the tube at finite values of Bo.

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