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Thin film drainage between pre-inflated capsules or vesicles[1]
MARTIN KEH, JOHANN WALTER, GARY LEAL, University of California, Santa Barbara — Capsules and vesicles are often used as vehicles to carry active ingredients or fragrance in drug delivery and consumer products and oftentimes in these applications the particles may be pre-inflated due to the existence of a small osmotic pressure difference between the interior and exterior fluid. We study the dynamics of thin film drainage between capsules and vesicles in flow as it is crucial to fusion and deposition of the particles and, therefore, the stability and effectiveness of the products. Simulations are conducted using a numerical model coupling the boundary integral method for the motion of the fluids and a finite element method for the membrane mechanics. For low capillary numbers, the drainage behavior of vesicles and capsules are approximately the same, and also similar to that of drops as the flow-independent and uniform tension due to pre-inflation dominates. The tension due to deformation caused by flow will become more important as the strength of the external flow (i.e. the capillary number) increases. In this case, the shapes of the thin film region are fundamentally different for capsules and vesicles, and the drainage behavior in both cases differs from a drop.

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Martin Keh
University of California, Santa Barbara

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