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Drop detachment in the presence of a diffusion-controlled surfactant at finite Peclet FANG JIN, KATHLEEN STEBE, Johns Hopkins University — When a buoyant drop is injected into a viscous external surfactant solution, the drop deforms to form an elongated shape, and detaches by the rapid formation of a neck. The thinning of this neck is driven by the local surface-tension related stresses, and resisted by the outflow of viscous liquid from the neck. Surfactant accumulates in the region of the neck as the interface contracts rapidly. The surfactant desorbs to establish a sublayer concentration adjacent to the interface in equilibrium with the local surface concentration, and diffuses away from the surface in an attempt to restore equilibrium. In the event that the diffusion flux is slow compared to the local rate of surface contraction, the local surface tension is reduced, slowing the rate of neck thinning and changing the neck shape. The occurrence of these non-equilibrium effects for a system of fixed physical chemistry as a function of surfactant concentration is studied numerically at finite Peclet number and compared to prior results in the sorption controlled limit.

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