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Armoring confined bubbles in concentrated colloidal suspensions

YINGXIAN YU, SEPIDEH KHODAPARAST, HOWARD STONE, Princeton University — Encapsulation of a bubble with microparticles is known to significantly improve the stability of the bubble. This phenomenon has recently gained increasing attention due to its application in a variety of technologies such as foam stabilization, drug encapsulation and colloidosomes. Nevertheless, the production of such colloidal armored bubble with controlled size and particle coverage ratio is still a great challenge industrially. We study the coating process of a long air bubble by microparticles in a circular tube filled with a concentrated microparticles colloidal suspension. As the bubble proceeds in the suspension of particles, a monolayer of micro-particles forms on the interface of the bubble, which eventually results in a fully armored bubble. We investigate the phenomenon that triggers and controls the evolution of the particle accumulation on the bubble interface. Moreover, we examine the effects of the mean flow velocity, the size of the colloids and concentration of the suspension on the dynamics of the armored bubble. The results of this study can potentially be applied to production of particle-encapsulated bubbles, surface-cleaning techniques, and gas-assisted injection molding.

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