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an Armored Droplet Approaching a Fluid-Fluid Interface[1]

ALIREZA HOOSHANGINEJAD, SUNGYON LEE, University of Minnesota —

Droplets coated with a protective armor of particles are relevant in the stabilization of emulsions and drug delivery applications. Here, we consider a stratified system comprising three layers of fluids with two immiscible interfaces: a water-Iso Propanol Alcohol mixture, silicone oil, and water. When negatively buoyant particles are added to the system, they self-assemble into a granular raft on the water-IPA and oil interface. As the size of the raft increases, the raft becomes unstable, leading to the encapsulation of water-IPA and the formation of armored droplets in the oil layer. These armored droplets sink down in the oil until they approach the oil-water interface. In this study, we focus on the hydrodynamic interactions between the water-IPA armored drop and the oil-water interface. Two distinct behaviors are exhibited by armored drops: rupture or pinch-off. We demonstrate that the size and the weight of the armored droplet determine the transition between the two regimes. We present our experimental observations and discuss the physical mechanism that underlies them.

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Alireza Hooshanginejad
University of Minnesota

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