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Armored droplets from particle rafts and an application to environmental remediation HOWARD A. STONE, Princeton University, MANOUK ABKARIAN, Universite Montpellier, SUZIE PROTIERE, Institut Jean le Rond d'Alembert, Paris, JEFF ARISTOFF, Princeton University — Applications such as handling hazardous materials or containing chemical reactions involve encapsulating one fluid phase by a shell. In addition to surfactants, a variety of physicochemical approaches have been studied where nano- and/or micron-size particles organize at fluid-fluid interfaces to form some sort of shell. Gravity typically plays an insignificant role compared to surface forces in establishing such "armored interfaces." More generally, however, it is well known that capillary and gravitational forces cause particles trapped at interfaces to self-assemble and organize into raft-like structures. We describe gravity-driven instabilities of particle rafts and show how the "interfacial granular dynamics" lead to encapsulation strategies involving stable particle-armored droplets. Experimental results are compared with mathematical models of the composite objects in order to establish a quantitative description of our observations. The application of these ideas to environmental remediation will be described.

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