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Collapse of a Granular Raft – Experiments and Modeling[1]
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Particle-laden fluid interfaces exhibit an interplay between interfacial energy, which minimizes the surface area, and steric repulsion between particles, which provides a constraint on the minimum area. We experimentally and theoretically investigate the behavior of an initially flat fluid-fluid interface covered in rigid passive particles under isotropic compression. Specifically, we investigate spherical glass particles with a diameter in the range of 0.1 mm to 2 mm deposited on a water-air or water-oil interface inside a conical funnel. We impose axisymmetric compression of the raft by lowering the water level inside the funnel. For small particles or large density differences between the two fluids, single particles are expelled from the raft under compression. However, for larger particles or small density differences between the two fluids, the raft forms a collective crease under compression. Based on these observations, we construct a model for the deformation of the interface and the re-distribution of particles along the interface, and use this model to predict these two failure modes.

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