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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