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Collapse and sinking of self-assembled sphere clusters on a liquid-liquid interface STEVEN JONES, NIKI ABBASI, ABHINAV AHUJA, VIVIAN TRUONG, SCOTT TSAI, Ryerson University — The self-assembly of objects on a liquid-liquid interface is a phenomenon that has attracted a lot of attention. When a single settling sphere has insufficient gravitational energy to break through a liquid-liquid interface, multiple spheres can self-assemble on the interface, by capillary and buoyancy forces, to form a cluster. If a sphere cluster's gravitational energy overcomes the interfacial tension energy barrier of the liquid-liquid interface, the cluster will sink through the interface. Here we show with experiments that small spheres approaching an oil-water interface will self-assemble into clusters, and at a critical size pass through the interface. We demonstrate that the size of a sphere cluster at the time of interface breakthrough can be controlled by altering the sphere radius and the liquid-liquid interfacial tension. We also find that the critical cluster size changes depending on the way the spheres are deposited: spheres deposited into a monolayer raft configuration will sink though the interface as a larger cluster than spheres stacked into a spheroidal geometry. We find that the number of spheres in each sinking cluster scales with power-laws of the Bond number, and we observe different power-laws for raft and stack cluster configurations.

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