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Mixing in Sessile Drops Merging on a Surface SHELLEY ANNA, YING ZHANG, SAMUEL OBERDICK, STEPHEN GAROFF, Carnegie Mellon University — We investigate the mixing of two sessile drops that merge on a surface. The drops consist of low viscosity glycerol-water mixtures deposited on a silicone elastomer surface with contact angle near 90°. We observe the shape of the drops and the location of their intersection by placing a fluorescent dye in one drop and using a laser light sheet to image a plane perpendicular to the surface. The initial healing of the meniscus bridge between the merging drops, and the damping of capillary waves appearing on their surfaces occur on timescales comparable to the inertio-capillary relaxation time. However, the interface between the two fluids remains sharp, broadening diffusively over several minutes. The shape of the merged drops and the boundary between them also continues to evolve on a timescale of minutes. This later motion is controlled by gravity, capillary pressure, and viscous stresses. Images of the 3D drop shape indicate that small contact line motions are correlated to the slow relaxation. Although the two drops contain identical liquids except for the presence of the dye, the shape of the interface consistently evolves asymmetrically, assuming a characteristic crescent shape. We note that very tiny surface tension gradients can produce an asymmetric flow like the one observed here. We characterize the long timescale flow as a function of the drop sizes, and we use numerical simulations to aid in elucidating the essential physics.

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