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Drop dynamics on a thin film: Drop engulfment PILNAM KIM, Princeton University, ANDREAS CARLSON, The Royal Institute of Technology, HOWARD A. STONE, Princeton University — When a liquid drop spreads on a thin film of another immiscible liquid, the liquid drop and film deform to minimize the surface energy. We investigate the dynamics of the motion of a water drop that comes in contact with a thin film of a silicone oil. We first present the engulfment of a water drop by a silicone film. We identify that the drop engulfment is dominated by the drop size and is independent of the thin film thickness. The interface where water/oil/air meets deforms as a spreading event, where the radius evolves as a power-law in time. If the solid that supports the thin oil film is hydrophobic, the film between the drop and the solid remains stable even if it is thinned by gravity, making the drop "float" on the solid. In the presence of a gradient in solid surface energy, the floating water drop moves toward the parts of the solid surface that have the highest energy. We suggest that this motion is caused by the imbalance in surface forces at the front and rear of the droplet, where the driving force is believed to originate from the interface-solid substrate interaction and acts through the thin silicone film.

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