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Drop dynamics on a thin film: Thin film rupture ANDREAS CARLSON, The Royal Institute of Technology, PILNAM KIM, HOWARD A. STONE, Princeton University — The spreading of a water drop on an oil film that covers a solid substrate is a common event in many industrial processes. We study in experiments the dynamics of a water drop on a thin silicone oil film and quantify its interaction with the solid substrate that supports the film. The oil film becomes unstable and ruptures for solids that are hydrophilic. We determine the “waiting time,” the time it takes the water drop to drain the silicone film. This timescale is found to highly depend on how well water wets the solid, illustrating the interplay between intermolecular and hydrodynamic forces in the phenomenon. A phase diagram for the thin film stability is extracted based on water’s equilibrium contact angle on the solid, which shows that we can either promote or inhibit de-wetting. As water comes in direct contact with the solid, it spreads and peels off the silicone film. We show the influence of viscosity, equilibrium contact angle and film height on the opening radius of the hole formed as the solid de-wets.

Howard A. Stone
Princeton University

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