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Patterns, Instabilities, Colors, and Flows in Vertical Foam Films
SUBINUER YILIXIATI, EWELINA WOJCIK, YIRAN ZHANG, KRUPA SHAH, VIVEK SHARMA, Chemical Engineering, University of Illinois at Chicago — Understanding and controlling the drainage kinetics of thin films is an important problem that underlies the stability, lifetime and rheology of foams and emulsions. We follow the drainage kinetics of vertical foam films using imaging and color science. Interference between light reflected from two surfactant-laden surfaces that are 100 nm - 10 micron apart leads to thickness-dependent iridescent colors in the visible region. Below 50 nm the thin films appear as black. In this study, we utilize the thin film interference colors as markers for identifying patterns, instabilities and flows within vertical foam films. We study the emergence of thickness fluctuations near the borders (i.e. marginal regeneration) and within thinning films. Finally, we elucidate how buoyancy, capillarity, convection and gravity-driven instabilities and flows, are affected by the choice and concentration of constituents. We find fascinating examples of two-dimensional hydrodynamics and unexplained, if not unprecedented, drainage kinetics.

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