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Visualizing Nanoscopic Topography and Patterns in Freely Standing Thin Films VIVEK SHARMA, YIRAN ZHANG, SUBINUER YILIXIATI, Chemical Engineering, University of Illinois at Chicago — Thin liquid films containing micelles, nanoparticles, polyelectrolyte-surfactant complexes and smectic liquid crystals undergo thinning in a discontinuous, step-wise fashion. The discontinuous jumps in thickness are often characterized by quantifying changes in the intensity of reflected monochromatic light, modulated by thin film interference from a region of interest. Stratifying thin films exhibit a mosaic pattern in reflected white light microscopy, attributed to the coexistence of domains with various thicknesses, separated by steps. Using Interferometry Digital Imaging Optical Microscopy (IDIOM) protocols developed in the course of this study, we spatially resolve for the first time, the landscape of stratifying freely standing thin films. We distinguish nanoscopic rims, mesas and craters, and follow their emergence and growth. In particular, for thin films containing micelles of sodium dodecyl sulfate (SDS), these topological features involve discontinuous, thickness transitions with concentration-dependent steps of 5-25 nm. These non-flat features result from oscillatory, periodic, supramolecular structural forces that arise in confined fluids, and arise due to complex coupling of hydrodynamic and thermodynamic effects at the nanoscale.

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