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Domain and nanoridge growth kinetics in stratifying foam films
YIRAN ZHANG, VIVEK SHARMA, Chemical Engineering, University of Illinois at Chicago — Ultrathin films exhibit stratification due to confinement-induced structuring and layering of small molecules in simple fluids, and of supramolecular structures like micelles, lipid layers and nanoparticles in complex fluids. Stratification proceeds by the formation and growth of thinner domains at the expense of surrounding thicker film, and results in formation of nanoscopic terraces and mesas within a film. The detailed mechanisms underlying stratification are still under debate, and are resolved in this contribution by addressing long-standing experimental and theoretical challenges. Thickness variations in stratifying films are visualized and analyzed using interferometry, digital imaging and optical microscopy (IDIOM) protocols, with unprecedented high spatial (thickness <100 nm, lateral ˜500 nm) and temporal resolution (<1 ms). Using IDIOM protocols we developed recently, we characterize the shape and the growth dynamics of nanoridges that flank the expanding domains in micellar thin films. We show that topographical changes including nanoridge growth, and the overall stratification dynamics, can be described quantitatively by nonlinear thin film equation, amended with supramolecular oscillatory surface forces.

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