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Nonuniformities in Miscible Two-Layer Two-Component Thin Films CHRISTOPHER LARSSON, SATISH KUMAR, University of Minnesota — Obtaining uniform liquid films is a problem integral to many industries and requires an understanding of capillary leveling, Marangoni flow, evaporation, and many other phenomena. Multilayer films arise in various contexts where films must have multiple layers with distinct properties for optimal performance. Simultaneously coating multiple liquid layers presents a multitude of technological challenges that add to the complexity of obtaining uniformity. It has been experimentally demonstrated that two-layer films with miscible layers can undergo dewetting, but theoretical understanding of this phenomenon is lacking. Through a lubrication-theory-based model, we study the mechanisms initiating dewetting in miscible two-layer two-component films. The model film consists of nonvolatile solvent and solute with constant density and viscosity. Two coupled fourth-order nonlinear PDEs that describe the time-evolution of the film height and solute concentration are derived and solved with a spectral method. A disparity in the initial solute concentration between the film layers drives flows that lead to height nonuniformities and eventually dewetting. A parametric study is conducted to examine the influence of system parameters on this behavior and develop several scaling relations.

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