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How do evaporating thin films evolve? Unravelling phase-separation mechanisms during solvent-based fabrication of polymer blends OLGA WODO, State Univ of NY - Buffalo, BASKAR GANAPATHYSUBRAMANIAN, Iowa State University — Solvent-based fabrication is a flexible and affordable approach to manufacture organic thin films made from any combination of polymer, copolymers and/or small molecules. The properties of products made from such films can be tailored by the morphology of the films. Hence, it is of paramount importance to understand morphology evolution during fabrication. However, it is challenging to experimentally visualize morphology evolution during processing (processes involved are highly dynamic at low scale and typical components do not show high contrast). Consequently, details of morphology evolution during solvent-based thinning deposition are still under debate. Here, we identify four modes of phase formation and subsequent propagation within the thinning film during solvent-based fabrication. We unravel the origin of this behavior. Specifically, we focus on fundamental questions, when and where phases are formed, and how they evolve to form the final structure. We utilize a linear stability analysis to identify which mechanism of phase-separation is chosen for a given processing condition. Finally, we construct a mode diagram that maps processing conditions with individual modes. The idea introduced here enables choosing processing conditions to tailor film morphology characteristics and paves the ground for a deeper understanding of morphology control with the ultimate goal of precise, yet affordable, morphology manipulation for a large spectrum of applications.

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