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Designing functional materials with interfacial instabilities in thin films PIERRE-THOMAS BRUN, JOEL MARTHELOT, Princeton University, LIZ STRONG, PEDRO REIS, MIT — We harness interfacial instabilities in thin liquid films to spontaneously fabricate lens-shaped solid structures. A liquid elastomeric polymer is coated on a flat substrate, which is then turned upside-down, leading to the formation of a pattern of drops emerging through the Rayleigh-Taylor instability. As the polymer cures, this array of liquid drops solidifies, thereby permanently structuring the geometry of the originally fluid system. Upon curing, the structure can be used as a network or the solid drops may be peeled off from the substrate and used individually as lenses, making this method an inherently scalable fabrication pathway. Carefully designing a layout of surface defects, etched on the substrate onto which the thin film is initially deposited, is used as seed perturbations that trigger the instability in a controlled manner. This perturbation field significantly augments the monodispersity of the final solid structures, thereby making the fabrication process both robust and scalable. Timing and initial conditions allow us to control the drops amplitude. While centimeter drops are the norm, we demonstrate that much smaller scales are attainable, so that this method could be used in the micro-fabrication of soft materials.

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