Abstract Submitted
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Discrete and continuum dynamics of elastocapillary coalescence of plates and pillars[1] ZHIYAN WEI, School of Engineering and Applied Sciences, Harvard University, Cambridge, MA 02138, USA, T. SCHNIEDER, Max Planck Institute, Am Fassberg 17, D-37077 Goettingen, Germany, J. KIM, H.-Y. KIM, Department of Mechanical and Aerospace Engineering, Seoul National University, Seoul 151-744, Korea, J. AIZENBERG, School of Engineering and Applied Sciences, Harvard University, Cambridge, MA 02138, USA, L. MAHADEVAN, School of Engineering and Applied Sciences, Department of Physics, Harvard University, Cambridge, MA 02138, USA — When a fluid-immersed array of lamellae or filaments that is attached to a substrate is dried, evaporation leads to the formation of menisci on the tips of the plates or pillars that bring them together. Building on prior experimental observations, we use a combination of theory and computation to understand the nature of this instability and its evolution in both the two-dimensional and three-dimensional setting of the problem. For the case of lamellae, we derive the interaction torques based on the relevant physical parameters, predict the critical volume of the liquid and the 2-plate-collapse eigenmode at the onset of instability, and use numerical simulations to explain the hierarchical cluster formation and characterize the sensitive dependence of the final structures on the initial perturbations. We also characterize these at a continuum level by partial differential equations. We then generalize our analysis to treat the problem of pillar collapse in 3D, where the fluid domain is completely connected.

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