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Experimental Study of Fluid Structure Formation from the Linear to Non-Linear Regime in Polymer Nanofilms Subject to Benard-Like Instability YU LIU, EUAN MCLEOD, SANDRA TROIAN, California Institute of Technology, 1200 E California Blvd, MC 128-95, Pasadena, CA 91125 — Researchers continue to seek novel nanopatterning techniques which unlike conventional photolithography can yield more rapid, less expensive pattern definition compatible with large areas, curved substrates and polymeric materials. Here we describe insitu measurements of the spontaneous formation and growth of fluid elongations in molten polymer nanofilms. These films, confined in between two substrates held at different temperature, exhibit a free surface subject to thermocapillary instability. Unlike the typical Benard instability in which the fluid interface adopts an undulatory shape with small fixed amplitude, this system generates pillar-like features spaced tens of microns apart which evolve continuously toward the cooler substrate. The pillar shape and size therefore depend on the period of exposure to the thermal gradient. Optical microscopy images obtained through a sapphire window patterned with a transparent cylindrical protrusion are used to compute the pair correlation function, coordination number and Fourier transform of structure formation as a function of time. In-plane hexagonal symmetry is only observed at relatively late times and lamellar or square symmetry is all too easily obtained for tilted or curved substrates.

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