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Tracking the Growth Rate of Nanopillar Formations Caused by Large Thermocapillary Forces EUAN MCLEOD, SANDRA TROIAN, California Institute of Technology, 1200 E. California Blvd MC 128-95, Pasadena, CA — Viscous nanofilms are known to deform spontaneously into periodic arrays of nanopillars when exposed to a strong transverse thermal gradient. Comparison of the characteristic pillar spacing in experiment with predictions of linear instability analysis suggests that thermocapillary forces, and not acoustic phonon pressure or electrostatic image charge, are likely the dominant destabilizing mechanism [1]. Examination of the dynamical shapes and growth rates of emerging peaks provides an even more stringent test of the physical mechanism underlying the deformation process. Here we report measurements based on white light interferometry in which the reflected intensity from individual color channels is used to monitor the growth and shape of 3D formations in molten polymer nanofilms. Numerous experiments were conducted to isolate the influence of various operating parameters. These measurements exhibit an extended regime characterized by exponential growth which persists well beyond small amplitude deformations. The corresponding growth rates agree well with predictions of linear stability theory based on thermocapillary flow; however, the inferred film viscosities are systematically larger than bulk values.

[1] E. McLeod, Y. Liu, and S. M. Troian, Phys. Rev. Lett. 106, 175501(2011)

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