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Influence of Temperature Dependent Viscosity on the Evolution of Pillar Instabilities in Polymer Nanofilms MATHIAS DIETZEL, SANDRA TROIAN, California Institute of Technology, 1200 E. California Blvd., MC 128-95, Pasadena, CA 91125 — We have previously shown that evolution of periodic elongated pillar arrays in nanoscale polymer films subject to a significant transverse thermal gradient represents an extreme limit of Benard-instability. Such ultrathin films allow access to a regime in which destabilizing thermocapillary forces outweigh stabilization by capillary and gravitational forces by many orders of magnitude. In prior work, the melt viscosity was assumed constant. Here we explore the influence of increasing viscosity as the nanopillars evolve to approach a cooler target. A comparison of models incorporating either a linear or exponential variation of viscosity with temperature with previous results reveals that the pillar spacing obtained from linear stability analysis is only marginally affected. Full numerical simulations beyond the linear regime, however, indicate a more noticeable influence on pillar shape and even more so, pillar growth times. The influence of thermal viscous effects on this moving boundary problem is therefore critical to estimates of processing times for technological applications.

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