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Controlled viscous and viscoelastic instabilities of polystyrene film on topographically patterned poly(methyl methacrylate) ZHENG ZHANG, DAE UP AHN, YIFU DING, University of Colorado at Boulder — We report the spontaneous morphological evolution of polystyrene (PS) films spin-cast on pre-patterned poly(methyl methacrylate) (PMMA) substrates, at annealing temperatures above the glass transition temperatures of both polymers. The influences of the molecular weights and spin-cast volume of PS on the morphological development were systematically examined. Both were found to modulate the instabilities and result in distinctive morphologies. In particular, thick PS films that fully covered the topographically patterned PMMA substrate would dewet through nucleation and growth of randomly formed holes. However, the rupture of thinner PS films were manifested through formation of arrays of non-axisymmetrically confined threads and subsequent capillary instabilities of these threads. Low and high molecular weights of PS gave rise to two different modes of thin-thread instabilities, identified as varicose and peristaltic mode, respectively.

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