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Morphology driven spinodal decomposition of film topography in symmetric diblock copolymer thin films ROBERT D. PETERS, Department of Physics & Astronomy and the Brockhouse Institute for Materials Research, McMaster University, Hamilton, ON, Canada, L8S 4M1, PAWEL STASIAK, MARK W. MATSEN, School of Mathematical and Physical Sciences, University of Reading, Whiteknights, Reading, UK, KARI DALNOKI-VERESS, Department of Physics & Astronomy and the Brockhouse Institute for Materials Research, McMaster University, Hamilton, ON, Canada, L8S 4M1 — At equilibrium, symmetric diblock copolymer thin films will microphase separate into lamellae oriented parallel to the substrate. If a film is not exactly commensurate, the free surface will form regions of two different film heights separated by one characteristic lamellar bilayer height. Though this equilibrium morphology has been well studied, the intermediate morphologies formed along the ordering pathway as the film transitions from a disordered melt to an equilibrated film with a terraced topography has received relatively little attention.Using atomic force microscopy we probe the topology and morphology evolution at the free surface of maximally incommensurate poly(styrene-b-methyl methacrylate) films during annealing.The film initially develops lamellae at the free surface with a perpendicular orientation, followed by the continuous growth in amplitude of fluctuations in film surface topography, indicating a spinodal process.Using self-consistent field theory we confirm that this spinodal decomposition of film topography is induced by an unstable mixed morphology intermediate state consisting of parallel lamellar domains at the substrate, and perpendicular lamellae at the free surface.

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