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Effect of thickness on microdomain orientation in shear-aligned, cylinder-forming PS-PHMA thin films RALEIGH DAVIS, Princeton University, PAUL CHAIKIN, New York University, RICHARD REGISTER, Princeton University — Previous work has shown that application of a shear stress can impart well-defined orientational order to the microdomains of cylinder-forming poly(styrene)-b-poly(n-hexylmethacrylate) (PS-PHMA) thin films. Unlike many block copolymer thin films, PS-PHMAs tend not to form terraces (islands/holes). As a result, film thickness plays an important role in determining the orientation of the cylindrical microdomains. Here we study the effect of film thickness on the morphology of aligned and unaligned PS-PHMA films. Films with a gradient in thickness were generated, via flow coating, and then imaged using atomic force microscopy to examine the microdomain morphology before and after shear alignment. As a function of thickness the unsheared film morphology oscillated between dots (either spheres or cylinders oriented perpendicularly to the substrate) and lines (cylinders oriented parallel to the substrate), with the highest fraction of lines occurring at film thicknesses corresponding to an integral number of cylinder domain spacings. For thicknesses larger than three domain spacings, the oscillation ceased and complete coverage by line patterns was observed. Once shear-aligned, the thicknesses that exhibited the largest fraction of lines pre-shear, showed the highest quality of alignment post-shear.

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