Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Surface Morphology Diagram for Cylinder-Forming Block Copolymer Thin Films ALAMGIR KARIM, University of Akron, XIAOHUA ZHANG, JACK DOUGLAS, RONALD JONES, Polymers Division, NIST — We investigate the effect of annealing temperature (T) and film thickness (hf) on the surface morphology of flow coated films of a cylinder forming block copolymer, poly (styrene-block-methyl methacrylate) (PS-b-PMMA). A transition from a perpendicular to a parallel cylinder orientation with respect to the substrate is observed upon increasing hf when the substrate interaction is highly selective for one of the blocks (PMMA) and the polymer-air interface has a nearly neutral interaction with both blocks. Surface morphology transitions with increasing hf are observed in these model 'frustrated-interaction' films: (a) first, a transition occurs from cylinders oriented parallel to the substrate to a mixed or 'hybrid' state where the two orientations coexist (b) this hybrid morphology then transforms to cylinders oriented perpendicularly to the polymer-air interface for larger hf. The characteristic values of hf defining these surface morphological transitions depend on T and we construct a surface morphology diagram as a function of hf and T. The surface morphology diagram is found to depend on the method of film formation (flow coated versus spun cast films) so non-equilibrium effects evidently have a large effect on the surface pattern morphology. In particular, the residual solvent within the film (quantified by neutron reflectivity measurements) can have a large effect on the surface morphology diagram and the physics of glass-formation is also apparently important.

Alamgir Karim
University of Akron

Date submitted: 21 Nov 2008 Electronic form version 1.4