

Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Effects of ultra-fast solvent evaporation in solvent vapor annealed cylinder-forming block polymer thin films A. BARUTH, G. NELSON, C. DRAPES, J. WONG, M. GRANT, Creighton Univ, Omaha, NE — Despite continued advances in directed self-assembly of block polymer thin films *via* solvent vapor annealing, a standardized process remains absent. There remain several complicating factors, notably solvent evaporation rate. Recent theoretical models point to this rate dominating the propagation of a given morphology into the bulk of a thin film following nucleation from the free surface. During this drying process, the film undergoes a competition between thermodynamically driven phase separation and kinetically controlled chain mobility. We, among others, have demonstrated that faster solvent removal can enhance propagation down to the substrate. Perpendicularly aligned cylinders are one illustrative example. To further quantify this effect, and look at ultra-fast time scales, we have constructed a solvent vapor annealing chamber that computer-controls evaporation times down to 15 ms. *In situ* spectral reflectance, with 10 ms temporal resolution, monitors the swelling and evaporation. We will present results on cylinder-forming polystyrene-*block*-polylactide thin films swollen to near disorder with tetrahydrofuran, followed by immediate solvent evaporation. Our data reveals control over evaporation times, ranging from 15 ms to several seconds, and the discovery of various evaporation types, previously undetected, including linear, exponential and combinations. Furthermore, atomic force micrographs correlate surface morphologies (both free and substrate) of the resultant films with each evaporation condition. Funded by Nebraska EPSCoR.

Andrew Baruth
Creighton Univ

Date submitted: 06 Nov 2015

Electronic form version 1.4