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Investigation of solvent annealing time dependence on morphology formation in polystyrene-*block*-polylactide thin films RYAN GNABASIK, GUNNAR NELSON, ANDREW BARUTH, Creighton Univ — Solvent vapor annealing exposes a block polymer film to the vapors of one or more solvents, swelling the film. This process increases polymer mobility and can direct a self-assembly process by tuning the surface energy. Despite its efficacy to produce well-ordered, periodic nanostructures, no standardized production scheme exists. This is primarily due to a lack of understanding the intricate role multiple, incommensurate parameters play. By analogy to thermal annealing of elemental solids, the time a thin film spends in an equilibrium solvent concentration is one factor that will dictate the degree of ordering. To elucidate, optimized annealing conditions for perpendicular cylinder forming polystyrene-*block*-polylactide exist at solvent concentrations just below the order-disorder transition, where the kinetic and thermal processes required for recrystallization and crystal growth are optimally fast (similar to thermal annealing). By use of a purpose-built, climate-controlled solvent annealing chamber, we map out the annealing time dependence for non-optimized solvent concentrations. Namely, at lower solvent concentrations, where mobility is limited, longer times are required for large lateral correlation lengths. *In situ* spectral reflectance monitors solvent concentration, regulated *via* a mass-flow controlled solvent inlet, offering precision control over annealing. Atomic force microscopy, in conjunction with O₂ plasma etching, provides 3-dimensional imaging of the nanoscale morphology. This work was funded by NASA Nebraska Space Grant.

Ryan Gnabasik
Creighton Univ

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