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Optimization of long-range order in solvent-annealed polystyrene-*b*-polylactide block polymer thin films for nanolithography A. BARUTH, Creighton University, M. SEO, C.-H. LIN, K. WALSTER, A. SHANKAR, M.A. HILLMYER, C. LEIGHTON, University of Minnesota — We demonstrate long-range order in solvent-annealed polystyrene-*b*-polylactide block polymer thin films for nanolithographic applications. This is accomplished *via* climate-controlled solvent vapor annealing, *in situ* solvent concentration measurements, and small angle x-ray scattering. By connecting the properties of swollen and dried films, we identify "best practices" for solvent-annealing, including that exposing block polymer films to a neutral solvent concentration just below the identified (*via* x-ray scattering) order-disorder transition, at low pressures, with fast solvent evaporation rates, will consistently yield large lateral correlation lengths (>6.9 μm) of hexagonally-packed cylinders that span the entire thickness of the film with center-to-center spacing ranging from 43 – 59 nm. The resultant films have sufficient fidelity for pattern transfer to an inorganic material, as evidenced by patterning of Ni metal nanodots using a damascene-type approach. We argue that our results can be qualitatively understood by analogy to thermal annealing of a single-component solid, where annealing just below the melting point leads to optimal recrystallization. Such reliability, combined with recently developed pattern-transfer techniques, places this cheap and rapid method of nanolithography in competition with conventional lithography schemes. Funded by NSF MRSEC and Creighton University Summer Research Award.

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