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Continuous and patterned deposition of functional block copolymer thin films using electrospray KRISTOF TOTH, HANQIONG HU, Yale University, MYUNGWOONG KIM, Inha University, PADMA GOPALAN, University of Wisconsin, MICHAEL LOEWENBERG, CHINEDUM OSUJI, Yale University — The delivery of sub-micron droplets of dilute polymer solutions to a heated substrate by electrospray deposition (ESD) enables precisely controlled and continuous growth of block copolymer (BCP) thin films. The ESD process overcomes many shortcomings of spin coating deposition, including the batch nature of the process, loss of potentially valuable polymer, limitations of solvent choice, and large time scales of annealing. We report that high substrate temperatures led to vertically oriented cylindrical microdomains of poly(styrene-block-methyl methacrylate) (PS-b-PMMA) at the film surface independent of the solvent composition and deposition rates utilized. Conversely, low substrate temperatures resulted in morphologies that were more sensitive to these parameters, with poorly ordered films of globular structures. We also report on the new possibility for patterned deposition of BCP films by spatially varying the electric field at the substrate using an underlying charged grid. To overcome surface charging, a novel alternating current electrospray process is proposed for deposition on non-conductive surfaces.

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