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Film growth kinetics and electric field patterning during electrospray deposition of block copolymer thin films[1] KRISTOF TOTH, Yale Univ, HANQIONG HU, YOUNGWOO CHOO, 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. Here we explore patterned deposition of BCP films by spatially varying the electric field at the substrate using an underlying charged grid, as well as film growth kinetics. Numerical analysis was performed to examine pattern fidelity by considering the trajectories of charged droplets during flight through imposed periodic field variations in the vicinity of the substrate. Our work uncovered an unexpected modality for improving the resolution of the patterning process via stronger field focusing through the use of a second oppositely charged grid beneath a primary focusing array, with an increase in highly localized droplet deposition on the intersecting nodes of the grid. Substrate coverage kinetics are considered for homopolymer deposition in the context of simple kinetic models incorporating temperature and molecular weight dependence of diffusivity. By contrast, film coverage kinetics for block copolymer depositions are additionally convoluted with preferential wetting and thickness-periodicity commensurability effects.

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