Direct solvent induced microphase separation, ordering and nanoparticles infusion of block copolymer thin films

ARVIND MODI, The University of Akron, ASHUTOSH SHARMA, Indian Institute of Technology Kanpur, ALAMGIR KARIM, The University of Akron — Kinetics of block copolymer (BCP) microphase separation by thermal annealing is often a challenge to low-cost and faster fabrication of devices because of the slow ordering. Towards the objective of rapid processing and accessing desired nanostructures, we are developing methods that enable a high degree of mobility of BCP phases while maintaining phase separation conditions via control of effective interaction parameter between the blocks in BCP thin films. We study the self-assembly of PS-P2VP thin films in various solvent mixtures. While non-solvent prevents dissolution of film into the bulk solution, the good solvent penetrates the film and makes polymer chains mobile. As a result of controlled swelling and mobility of BCP blocks, solvent annealing of pre-cast BCP thin films in liquid mixture of good solvent and non-solvent is a promising method for rapid patterning of nanostructures. Interestingly, we demonstrate simultaneous BCP microphase separation and infusion of gold nano-particles into selective phase offering a wide range of application from plasmonics to nanoelectronics.

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