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Hierarchical pattern formation through photo-induced disorder in block copolymer/additive composite films[1] LI YAO, JAMES WATKINS, Department of Polymer Science and Engineering, University of Massachusetts Amherst — Segregation strength in hybrid materials can be increased through selective hydrogen bonding between organic or nanoparticle additives and one block of weakly segregated block copolymers to generate well ordered hybrid materials. Here, we report the use of enantiopure tartaric acid as the additive to dramatically improve ordering in poly(ethylene oxide-block-tert-butyl acrylate) (PEO-b-PtBA) copolymers. Phase behavior and morphologies within both bulk and thin films were studied by TEM, AFM and X-ray scattering. Suppression of PEO crystallization by the interaction between tartaric acid and the PEO block enables the formation of well ordered smooth thin films. With the addition of a photo acid generator, photo-induced disorder in PEO-b-PtBA/tartaric acid composite system can be achieved upon UV exposure to deprotect PtBA block to yield poly(acrylic acid) (PAA), which is phase-miscible with PEO. Due to the strong interaction of tartaric acid with both blocks, the system undergoes a disordering transition within seconds during a post-exposure baking. With the assistance of trace-amounts of base quencher, high resolution, hierarchical patterns of sub-micron regions of ordered and disordered domains were achieved in thin films through area-selective UV exposure using a photo-mask.

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