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Thermal Manipulation of Block Copolymer Morphology by Focused Laser Spike (FLaSk) Annealing[1] JONATHAN SINGER, KEVIN GOTRIK, STEVEN KOOI, CAROLINE ROSS, EDWIN THOMAS, Department of Materials Science and Engineering, Massachusetts Institute of Technology — Block copolymer (BCP) thin films have a high potential as a pattern transfer medium for ultra-fine (<10nm) features. We introduce a novel technique for performing rapid local annealing of BCP films by focused laser spike (FLaSk) heating using visible wavelengths. This process may be viewed as imposing a local instantaneous landscape in both block mobilities and interaction parameters corresponding to the temperature profile. By controlling the duration and intensity of the dose, either the rapid local perfection of the equilibrium microdomain morphology or the controlled incorporation of metastable architectures is possible. Moreover, the ultra-short FLaSk process can limit polymer degradation, allowing faster microdomain manipulation by enabling higher temperature anneals. Utilization of a direct write stage allows for deliberate control of arbitrary thermal patterns and subsequent BCP ordering, with line width near the diffraction limit. FLaSk can be applied to nearly any BCP system and performed with other ordering techniques. Direct write experiments were combined with thermal finite elements simulations to probe the various material and process parameters necessary to enhance control of spherical and cylindrical BCPs and address challenges such as the use of thicker films.

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