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Dynamic Temperature Gradient Effects on Directed Self Assembly of Thin Films of Block Copolymer/Au Nanoparticle Multicomponent Systems REN ZHANG, GURPREET SINGH, University of Akron, ALEI DANG, MICHAEL BOCKSTALLER, Carnegie Mellon University, ALAMGIR KARIM, University of Akron — The influence of temperature and Au nanoparticle (NP) concentration on the morphology and properties of poly(styrene-b-methylmethacrylate) (PS-PMMA) block copolymer (BCP) thin films (thickness 80100nm) were investigated. The Au core was grafted with thiol-terminated polystyrene to ensure the preferential interaction to the PS domains. The concentration of Au NPs was varied between 0-10% with respect to PS-PMMA by weight. To induce microphase separation, both static oven annealing and a dynamic thermal field termed cold zone annealing (CZA) were performed. At low temperature annealing ($< 150^{\circ}$C), horizontal cylindrical morphologies were observed, while at high temperature annealing (150-210°C), an orientation transition of cylindrical microdomains from vertical to horizontal were observed with increasing Au NPs concentration coupled with an increase in reflective index. The morphology transition is attributed to the decreased thermal conductivity caused by the increasing heterogeneity and growing number of scattering centers. Additionally, we demonstrate unidirectional alignment of BCP/Au NP domains by a novel modification of the CZA method. The dispersion of Au NPs was investigated via TEM and AFM.

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