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Directed Assembly of Polymeric Films Filled with Gold Nanoparticles REN ZHANG, Univ of Akron, GURPREET SINGH, IBM Almaden Research Center, MICHAEL BOCKSTALLER, Carnegie Mellon University, ALAMGIR KARIM, Univ of Akron, UNIV OF AKRON, ALAMGIR KARIM TEAM, CARNEGIE MELLON UNIVERSITY COLLABORATION — Incorporation of nanoparticles (NPs) into polymer matrices has been explored extensively as an efficient way to fabricate novel functional materials, such as photonic bandgap materials, nanostructured solar cells, and high-density magnetic storage media. Towards that end, it is essential to disperse NPs in a well-controlled manner. We applied our unique dynamic thermal field processing method to gold nanopaticles with PS corona (AuNPs) into PS-b-PMMA cylinder forming block copolymer (c-BCP) thin films, and observed a sharp transition from vertical to horizontal cylinder orientation with AuNP loading fraction increasing. This transition is attributed to enrichment of AuNPs at the substrate side and favorable interaction of PMMA chains with gold cores. Furthermore, we investigated the dynamics of phase separation behavior of AuNP filled PMMA films as a function of time. It is intriguing that the homogeneous one-phase distribution of AuNPs transformed into a two-phase state upon thermal annealing accompanied with film surface undulating. Moreover, the phase separation phenomenon was effectively suppressed when confined with an elastomeric overlayer, thus leading to excellent dispersion.

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