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Directed Phase Separation of Brush-coated Nanoparticles in Miscible and Immiscible Polymeric Thin Films REN ZHANG, Univ of Akron, BONGJOON LEE, Carnegie Mellon University, JACK DOUGLAS, National Institute of Standards and Technology, SANAT KUMAR, Columbia University, MICHAEL BOCKSTALLER, Carnegie Mellon University, ALAMGIR KARIM, Univ of Akron — Fascinating as the combined properties of polymer/inorganic nanoparticle composite system, it is challenging to manipulate the distribution and assembly structures of the nanofillers at nanoscale with high loading fraction. Inspired by polymer blend phase separation, we expect similar behavior for blend of brush-coated nanoparticles and a polymer matrix with unfavorable enthalpic interactions. We confirm this relationship in blend thin films of polystyrene (PS) grafted gold nanoparticles (AuPS) in immiscible poly (methyl methacrylate) (PMMA). We show that application of soft-shear dynamic thermal zone annealing (DZA-SS) generates tunable directional aligned anisotropic nanoparticle structures. Alternatively, the phase-separated nanoparticle domains can also be organized into periodic nanostructures with well-defined shape and order with a simple geometric patterned elastomer confinement. These simple yet powerful strategies to fabricate nanopatterned NP arrays can be exploited for many nanotechnology applications.

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