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Nanostructure Evolution in Polymer/Nano-object Hybrids[1]

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Significant advances have recently been made in the synthesis of nano-objects with well-defined functions. Various size and shape of nano-objects are now readily available. In order to find useful applications those nano-objects are often mixed with polymers. We investigated the effect of hard additives, i.e., *interacting* magnetic nanoparticles (NPs), on the ordered morphology of block copolymers by varying NP concentration. In order to characterize the structural change of block copolymer associated with different NP loadings, small-angle X-ray scattering and transmission electron microscopy were employed. With the increase in NP concentration, domains of NP aggregates were observed. It is surprising to note that regular lattice-like aggregates with γ-Fe_2O_3 NPs induce an intriguing morphological transformation from the hexagonal cylinders to the body-centered cubic spheres via undulated cylinders of block copolymers, which does not show such morphological transition without NPs. These results are compared with the case where the interaction among NPs is relatively weak. In addition, we studied the effect of casting solvents and sample preparation conditions to confine such NPs in one of microphase separated domains. These results could add more flexibility in structural control and orientation of block templates in thin films opening up new applications.

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