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Self-assembly of large magnetic nanoparticles in ultrahigh molecular weight linear diblock copolymer films

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The preparation of block copolymer nanocomposite films that consist of nanoparticles (NPs) with diameters (D) of more than 10 nm is a challenging task. Herein, ultrahigh molecular weight (UHMW) linear polystyrene-*block*-poly(methyl methacrylate) (PS-*b*-PMMA) diblock copolymer was spin-coated as a template for the self-assembly of large iron oxide NPs (D = 27 nm), and the morphology of hybrid nanocomposites was governed by the concentration (c) of the iron oxide NPs. Via hydrogen bonding between the carboxylic acid groups on iron oxide and the PMMA side chains of the diblock copolymers, the NPs were selectively incorporated inside the PMMA spheres. Due to the rearrangement of the PMMA chains for accommodating the NPs, well-ordered spherical nanostructure were readily generated at low NP concentrations (c = 0.5 wt%). Most interestingly, a chain-like network appears inside the hybrid films at a high NP loading. All hybrid films show ferromagnetism at room temperature.

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