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Magnetic Nanoparticle/Block Copolymer Hybrid Materials for the Fabrication of Electromagnetic Devices[1] XINYU WANG, DAVID MESGUICH, JAMES WATKINS, University of Massachusetts Amherst — Significant efforts have been directed towards incorporating inorganic nanoscopic materials into well-defined, phase-separated block copolymer systems to create hybrid materials with intriguing optical, electrical or magnetic properties. Lin et al. recently reported the use of strong interactions between NPs and one segment of weakly segregated BCP systems to drive the assembly of well-ordered morphologies while confining the NPs specifically in the desired spherical, cylindrical or lamellar domains. Here we use this approach to assemble magnetic nanoparticles of high permeability into well ordered systems. Magnetic nanoparticles (MNPs) were synthesized and subsequent surface functionalization and/or ligand exchange reactions were carried out to decorate the NP surfaces with hydrogen-bonding donating groups and good particle dispersibility in polar solvents. The ligand attachment was confirmed by TGA and FTIR. The morphology evolution of BCP/MNPs composites was examined by SAXS. Such ferromagnetic structures with precise geometric control in nanoscale would enable the cost-effective fabrication of more advanced devices for AC electromagnetic applications such as miniaturized antennas with extended bandwidth, integrated microwave electronics and efficient power transformers.

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