

# Improvement of the Structural Ordering in Block Copolymer/Homopolymer/Nanoparticle Nanocomposites

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## Abstract

In this study, we investigate the effect the Fe<sub>3</sub>O<sub>4</sub> addition on the self-assembly of the nanocomposites formed by polystyrene-*block*-poly(ethylene oxide) (PS-*b*-PEO) diblock copolymer, PS homopolymer, and Fe<sub>3</sub>O<sub>4</sub> nanoparticles, through identifying a significant improvement of the structural ordering. The lamellae-forming PS-*b*-PEO diblock copolymer was firstly blended with a PS homopolymer in the corresponding matrix phase to induce the hexagonally packed cylinders (HEX), which however exhibited very low order in the cylindrical microdomains of HEX. While if the PS/PS-*b*-PEO blend was further hybridized with the Fe<sub>3</sub>O<sub>4</sub> nanoparticles to form PS/PS-*b*-PEO/Fe<sub>3</sub>O<sub>4</sub> nanocomposites, the ordering of the HEX structure could be greatly improved, as the nanoparticles localized in the microdomains may serve as a structure-directing agent in this blend system. However, if the microdomains were extremely swollen by the addition of a large amount of Fe<sub>3</sub>O<sub>4</sub> nanoparticles, the blend system was characterized by the absence of any ordered structure.

**Keywords** - *block copolymer, nanoparticle, hexagonally packed cylinder*