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EXPLORING THE ROLE OF NANOPARTICLE GEOMETRY ON THE MORPHOLOGICAL EVOLUTION OF CYLINDERICAL POLYSTYRENE-B-POLY (ETHYLENE-BUTYLENE)-B-POLYSTYRENE (SEBS) TRIBLOCK CO-POLYMER

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Block copolymer (BCP) nanocomposites systems have attracted considerable technical and scientific interests. However, some aspects of these composite nanostructured materials including the impact of nanoparticle (NPs) geometry have not been comprehensively studied. The objective of present study is to examine the role nanoparticle geometry (carbon nanotube/graphene nanosheet) on the microstructural development of BCP hybrids based on cylindrical forming polystyrene-b-poly (ethylene-butylene)-b-polystyrene (SEBS) by means of rheological techniques as well as small angle X-ray scattering (SAXS). TEM images implied good dispersion of both CNTs and graphene nanosheets in BCPs matrices. SAXS experiment was utilized to probe the structural morphology of neat and also hybrid BCP samples. As observed in the SAXS pattern of neat BCP, the Bragg peak position ratios qn/q1 are equal to 1,√3,√7, indicating that it consists of cylindrical domains spatially arranged in a 2-D hexagonal lattice. The obtained results for hybrid samples confirmed no microstructural changes and/or disruption of BCP ordering upon incorporation of NPs. The results of temperature sweep experiments implied an enhancing effect of NPs on increasing the microphase separation temperature and accelerating its kinetic mainly due to the confinement of BCP segments. Such confinement leads to the stretching of polymer chains and reducing the number of chain conformations, resulting to the domination of enthalpic energy over entropic one and microphase separated structure is formed at higher temperatures. Graphene nanosheets showed to have more significant influence on microphase separation due to the construction of a more constrained space as compared to CNTs. Moreover, DMTA results indicated that BCP samples exhibited three peaks associated to the damping of EB (ethylene-buthylene) domains, interphase region and PS domains. Incorporation of nanoparticles leads to the promotion of BCP microphase separation as confirmed by reducing the interphase region area.

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