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Segregated Polypropylene/Cross-linked Poly(ethylene-co-1-octene)/Multi-Walled Carbon Nanotube Nanocomposites with Low Percolation Threshold and Dominated Negative Temperature Coefficient Effect: Towards Electromagnetic Interference Shielding and Thermistors

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ABSTRACT: High-efficiently conductive networks have been well demonstrated to improve electrical properties of conductive polymer composites (CPCs). Here, a facile approach was introduced to control distribution of multi-walled carbon nanotubes (MWCNTs) in isotactic polypropylene/poly(ethylene-co-1-octene) blends (iPP/POE). The POE first melt-crosslinked by the addition of dicumyl peroxide, pulverized into small particles (40-60 meshes), then coated with iPP/MWCNTs composites, and finally compression molded to achieve the segregated iPP/POE/MWCNTs composites with MWCNTs confinedly dispersing in continuous iPP phase. This segregated structure could easily construct high-efficiently conductive networks, resulting in a low percolation threshold of 0.24 vol.%, high-performance electrical conductivity, and electromagnetic interference shielding effectiveness (EMI SE). For example, the EMI SE of ~25 dB could be achieved in the segregated nanocomposites with 3.0 vol.% MWCNTs (thickness 1.2mm) which reached the commercial requirement. Furthermore, the segregated samples also exhibited a relatively linear negative temperature coefficient (NTC) effect through wide temperature ranges of 45-120 ^{o}C and 150-190^{o}C because of anisotropic volume expansion effect caused by the segregated structure.