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Ultra-large Sized Graphene Nano-platelets (GnPs) Incorporated Polypropylene (PP)/GnPs Composites Engineered by Melt Compounding and its Thermal, Mechanical, and Electrical Properties

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Abstract

In this study, polypropylene (PP) / graphene nanoplatelet (GnPs) nanocomposites with very large sized GnPs (~150 μm) are prepared by melt extrusion followed by injection molding. A number of characteristics including thermal, mechanical, and electrical properties are analyzed. DSC shows that the introduction of GnPs facilitates the crystallization of polymer matrix due to a role of GnPs that serves as seeds for heterogeneous nucleation, and XRD reveals that GnPs have a minor induction effect of β crystals. Taking advantage of the large size and high aspect ratio of GnPs, a relatively low percolation threshold of ~2.99 vol% is obtained with highly increased in-plane and through-plane electrical conductivity. The fitting of experimental data to the percolation theory indicates that GnPs are three dimensionally dispersed within the polymer matrix. The composites exhibit relatively limited mechanical enhancement due to compromising of GnPs by the shear force introduced during the compounding process. Overall, the usage of large sized GnPs is

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