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Influence Of Exfoliated Graphene Nanoplatelets On Thermal Stability Of Polypropylene Reinforced Hybrid Graphen-rice Husk Nanocomposites

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Abstract : A major challenge of polypropylene (PP) in high-heat application areas is its poor thermal stability. Under high temperature, PP burns readily with high degradation temperature and can self-ignite. In this study, PP is reinforced with hybrid filler of graphene (xGNP) and rice husk (RH) with RH at 15 wt%, and xGNP varied at 0.5, 1.0, 1.5, 2.0, 2.5, and 3.0 parts per hundred (phr) of the composite. Compatibilizer MAPP was also added in each sample at 4phr of the composite. Sample formulations were melt-blended using twin screw extruder and injection moulding machine. At xGNP optimum content of 1.5 phr, hybrid PP/RH/G1.5/MAPP nanocomposite increased in thermal stability by 24 °C and 30 °C compared to pure PP and unhybridized PP/RH composite respectively; char residue increased by 513% compared to pure PP and degree of crystallization (Xc) increased from 35.4% to 36.4%. The observed thermal properties enhancement in the hybrid nanocomposites can be related to the high surface area, gap-filling effect and exfoliation characteristics of the graphene nanofiller which worked in synergy with rice husk fillers in reinforcing PP. This study therefore, shows that graphene nanofiller inclusion in polymer composites fabrication can enhance the thermal stability of polyolefins for high heat applications.

Keywords : polymer nanocomposites, thermal stability, exfoliation, hybrid fillers, polymer reinforcement
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