Graphene/Polyolefin Nanocomposites prepared via in-situ Polymerization with Multilayer Graphene-Supported Single-Site Catalysts

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Carbon-based nanomaterial such as multilayer graphene (MLG) was used as catalyst support and nanofillers for ethylene or propylene polymerizations. The MLG-supported $(n\text{-BuCp})_2ZrCl_2$ catalyst system produced polyethylene with extremely high molecular weight (MW), much higher than the MW of polyethylene from unsupported $(n\text{-BuCp})_2ZrCl_2$ catalyst. We suggest that MLG can serve not only as a support for adsorption but also as an additional ligand to $(n\text{-BuCp})_2ZrCl_2$ during ethylene polymerization. The surface of graphene can be a strong and bulky ligand that is attached to $(n\text{-BuCp})_2ZrCl_2$. The β-hydrogen elimination mechanism can be disturbed by the bulky surface of graphene. The initial degradation temperature (T_{onset}) for the MLG/polyolefin nanocomposites increased by about 20 °C compared with neat polyolefin, and maximum mass loss temperature (T_{max}) increased by about 7 °C. It means the presence of graphene definitely improve thermal stability of polyolefin when it is dispersed in the polymer matrix. Nano-dispersed MLG can act as barriers to hinder the heat transfer within the MLG/polyolefin nanocomposites, which would shift to higher degradation temperature.