FILLED POLY(ETHYLENE TEREPHTHALATE) RHEOLOGY.COMBINATION OF EXPANDABLE GRAPHITE AND LAYERED CLAYS

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Expandable graphite (EG) and polyethylene terephthalate (PET) were melt blended to develop a new nanocomposite and the effect of combination of EG with nanoclays, namely Cloisite Na (CNa) and Cloisite 30B (C30B), on thermal and rheological properties has been investigated.
X-ray diffraction analysis coupled to transmission electron microscopy and rheology shows that PET–EG–clay compounds are characterized by an exfoliated and/or intercalated morphology as a function of the type of clay.
Different morphologies by XRD are identified for PET–clay composites: in fact, PET–CNa can be considered an immiscible system, namely a microcomposite, whereas PET–C30B appear intercalated nanocomposites, respectively, as confirmed by TEM observations.
Within the frequency range in consideration, PET–EG shows a Newtonian behavior as compared with neat PET due to the well-known lubricant effect of filler. Regarding samples loaded by only cloisites, a general increase of viscosity has been seen over all the frequency. These results suggest a certain disorder level in the distribution of silicate platelets within the polymer matrix.
At high frequencies, both PET and nanocomposites have a liquid-like behavior, therefore the differences in complex viscosity are small, while at low frequencies the transition from liquidlike behavior to solid-like one is observable. This phenomenon is generated by the formation of a percolated network due to the presence of strong interactions between silicate layers. Indeed, according to the literature, this trend found an explanation in the additive contributions of polymer matrix and filler: at high frequencies the viscous effect of the polymer matrix prevails, while at low frequencies the elastic effect of the filler is dominant and thus the newtonian plateau disappears.
Adding EG, the viscoelastic behavior of the composite containing C30B does not change in remarkable manner: the trend of the two curves is similar. Surprisingly, for what concerns PET–EG–CNa nanocomposite, the presence of EG affects dramatically its viscoelastic properties. This suggest a major compatibility of EG with CNa rather than with C30B, as shown also by higher percentage increase of the complex viscosity in the solid-like zone at low frequencies. The graphite seems to act as lubricant for the platelet sliding for CNa.