Dielectric and Rheological Characterization of Polymer/Graphene Oxide Nanocomposites

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The incorporation of graphene nanosheets (GNSs), a single-layered two dimensional (2D) carbon nanofillers within polymer matrices have attracted considerable interest over the last few years dueto their ability to improve significantly electronic, thermal and mechanical properties. However, exfoliation and complete dispersion of the graphene nanoplatelets, prerequisite for properties improvement ischallenging to achieve. The most common way to proceed is to use graphite oxide precursors which are more easily exfoliated by thermal expansion or dispersion in water and to modify them to prevent their reaggregation. The reduction is then performed by chemical or thermal treatment to recover the electronic structure of graphene. In this communication, we directly disperse graphene oxide within several polymers (polystyrene, polymethylmethacrylate, polyethylene oxide) using different methods starting from aqueous solution. The reduction of graphene oxide is then performed by thermal treatment. The presence of the polymer matrix prevents reaggregation of the graphene during the reduction step.The quality of the graphene oxide dispersion wascharacterized by rheological measurement to identify the most efficient dispersion method. Dielectric measurements combined with rheological analysis have been used to distinguish two phenomena that can occur during the thermal treatment on the nanocomposites, i.e. reduction of the graphene oxide and reorganization of the graphene dispersion to build a 3D network. These results confirm the possibility to achieve electrically conductive materials by thermal treatment on polymer/graphene oxide nanocomposites.