

Modification of Carbon Nanotubes and Graphene with 1-octadecylalcohol for Polymer Nanocomposites

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Carbon nanostructures such as carbon nanotubes and graphene are promising materials to be employed as filler in polymeric nanocomposites. At present, nanocomposites employing carbon-based reinforcement materials are dominated by carbon nanotubes (CNTs). Graphene, one-atom-thick planar sheet of sp^2 bonded carbon atoms, is a quasi-2-dimensional (2D) material. The fascinating properties of graphene and few layer graphene (FLG) have made it one of the most promising materials.¹ Its greatest aspect ratio and lower cost of preparation, since it is obtained from the naturally occurring graphite, make the graphene will gradually replacing carbon nanotubes.

However, the development of nanocomposites reinforced with this kind of carbon materials has been impeded by their difficult dispersion in matrix. Therefore, sometimes it is crucial their functionalization to make it compatible with a wide range of polymers.

The esterification reactions is one of the most employed reaction to covalently bound functional groups to CNT. This reaction have been also employed in graphene by using graphite oxide and subsequent reduction.²

Here we report the functionalization of graphene and CNT with long alkyl groups through a simple esterification reaction. The success of the modification was confirmed by FTIR, Raman, HNMR and TGA-mass techniques. The final products are soluble in dimethylformamide (DMF) giving stable solution by months.

The functionalization makes these materials compatible with vinyl polymers. We prepared nanocomposites of poly (vinyl chloride) (PVC) with both modified carbon nanostructures. The FTIR spectrum of the nanocomposite shows some interesting differences compared to separate materials. In the case of nanocomposites of PVC with CNT the carbonyl band of the modified-CNT (1633 cm^{-1}) shift to higher wavenumber. Furthermore, the intensity ratio of the C-Cl bands of PVC (I_{615}/I_{635}) is remarkably higher in the nanocomposite. Both effects evidence the effective polymer/filler interaction mainly by halogen bonding. However, other interactions such as van de Waals or dipole-dipole should not be discarded. These interactions are responsible by changes in the final properties.

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References

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[2] Horacio J. Salavagione, Gerardo Martínez, Marián A. Gómez. *Macromolecules*, 2009, 42, 6331

Figures

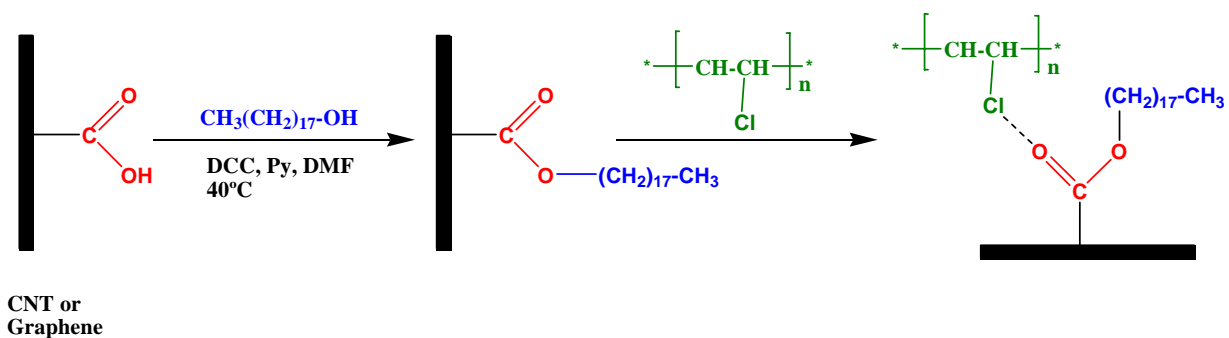


Figure 1. Schematic representation of the modification process and nanocomposite preparation.