Composites with Polymer-Grafted Carbon Nanotubes

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Carbon nanotube (CNT)/polymer composites exhibit the processability advantages of plastics, while conveying electrical conductivity characteristics suitable for electric transport, or for sensing functionalities. The success of their application depends on the ability to homogeneously disperse the CNT in the polymer matrices to form a stable conductive network. The structural strength of the nanocomposite is also desirable, and may be a requirement. The chemical functionalization of the CNT is known to improve the mechanical properties of the nanocomposites, although it is observed to have a negative influence on the electrical conductivity.

The present work reports the chemical modification of CNT to graft polycarbonate (PC) molecules to their surface, and the analysis of the CNT (as-received and PC-grafted) dispersion in PC by melt mixing using prototype equipment. The modified CNT were analyzed by thermogravimetry, X-ray photoelectron spectroscopy and scanning tunnelling microscopy, showing evidence for the formation of a polymer coating over the CNT. The nanocomposites were processed and reprocessed twice. The CNT dispersion was analyzed by optical microscopy using a similar analysis as described for PLA-grafted CNT [1], displaying considerable differences for CNT dispersion depending on their surface treatment. The electrical resistivity of the composites was measured, showing typically lower resistivity values for the composites with pristine CNT. The results also showed that resistivity of the composites with PC-grafted CNT may be considerably reduced depending on the processing steps.

[1] R.M. Novais, F. Simon, P. Pötschke, T. Villmow, J.A. Covas, M.C. Paiva, J. Polym. Sci., Part A: Polym. Chem., 51, 3740 (2013).