IMPROVED PROCESSING OF POLYANILINE-CARBON NANOTUBE NANOCOMPOSITES VIA WATER DISPERSIONS

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Carbon nanotubes (CNTs) had generally presented difficulties regarding its processing, mainly due to the strong interactions between individual tubes. In order to avoid this problem one of the most popular strategies is that of the chemical functionalization, covalent or non-covalent, to improve the interaction of CNTs with the environment and facilitate the separation (i.e.: dispersion) of the CNTs. Non-covalent functionalization, although it is weaker than the covalent one, has the advantage of not modifying drastically the special properties of CNTs. Conducting polymers are excellent candidates for this kind of non-covalent functionalization, that usually happens through π-π interactions. Nevertheless, up till now composites of conducting polymers and CNTs, despite its very interesting properties, have not improved significantly the processing of carbon nanotubes.

In this work we show a nanostructured composite between polyaniline (PANI) and multi-wall carbon nanotubes[1] (MWNTs) that can be dispersed in aqueous solutions in high concentrations, which allows different kinds of processing[2]. The content of MWNTs in these composites can be as high as 50% wt. without losing its water dispersibility. The low size of the nanostructures, the hydrophyllicity of PANI in the emeraldine salt state, and the good PANI-MWNT interaction are responsible for the high stability and homogeneity of the water dispersions of the material.

Some topics related to the properties, processing and application of the material will be presented. Among the most relevant properties of the material some of them come not only from the MWNTs (electrical conductivity, thermal stability), but also from PANI (hydrophyllicity, electrochemically or chemically tuneable properties, like color) and the morphology of the material (high surface area). The processing of the material could be directly done from water dispersions or via hydrophyllic polymer mixtures. With these approaches this material can be processed into films or fibers, employing techniques like spin coating, inkjet printing, electrospinning, wet spinning, etc. The wide range of properties and ways of processing make this material a promising candidate in many applications in fields such as organic photoelectronics, mechanical reinforcement of plastics, chemical detection, printable circuits, smart fabrics, and so on.

References:

[1] P. Jiménez, W.K. Maser, P. Castell, M.T. Martínez, A.M. Benito, Macromolecular Rapid Communications. *In Press*, DOI: 10.1002/marc.200800707 (Published Online: Jan 21 2009)
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Figures: