Title: PMMA/carbon nanotube nanocomposites foams for EMI shielding application

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With the rapid development of gigahertz electronic systems, electromagnetic pollution has become a serious problem, which justifies a very active quest for effective electromagnetic interferences (EMI) shielding materials. Polymers filled with carbon fillers have been widely investigated for EMI shielding purposes because of unique combination of electrical conductivity and polymer flexibility. The use of carbon nanotubes (CNTs) presents several advantages over conventional carbon fillers because they can percolate at very low contents. However, a major drawback of these nanocomposites is a high propensity to reflect the electromagnetic radiations rather than to absorb them. Indeed, the reflection of the signals results from a mismatch between the wave impedances for the signal propagating into air and into the material, respectively. The introduction of air into these nanocomposites by foaming will be favorable to the matching of the wave impedances of the material and the atmosphere.
The dispersion of CNTs within the polymer matrices before foaming is a fundamental step since the electrical conductivity will directly depend on it. Melt-mixing method has been the most studied dispersion technique due to its easy transferability to an industrial scale. However, the resulting conductivity is generally not optimal as a result of the low length of the cut CNTs. Other dispersion methods have been implemented such as in-situ-polymerization and coprecipitation. However, these techniques are hardly transferable to an industrial scale because they require large amounts of solvent. Here, we propose a new dispersing method that consists in the polymerization in presence of CNTs in a bad solvent of the polymer. During its formation, the polymer precipitates and entraps all the CNTs. Consequently, the amount of solvent needed is strongly decreased compared to the coprecipitation technique. Foaming of the resulting samples has then been performed using supercritical carbon dioxide and their EMI shielding properties have been measured.

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