Poly(lactic acid)-modified carbon nanotubes for poly(lactic acid) composites

Full Title

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Abstract

The present work reports the study of the effect of chemical functionalization of carbon nanotubes (CNT) on their dispersion in poly(lactic acid). The nanotubes were functionalized by the 1,3-dipolar cycloaddition reaction, generating pyrrolidine groups at the nanotube surface [1]. Further reaction of the pyrrolidine groups with poly(lactic acid) was studied in solution and in the polymer melt. The former involved refluxing the nanotubes in a dimethylformamide solution of the polymer, the latter was carried out by direct melt mixing in a microcompounder. The CNT collected after each process were characterized by thermogravimetry (TGA) and by X-ray photoelectron spectroscopy (XPS), showing evidence of polymer bonded to the nanotube surface only when the reaction was carried out in the polymer melt. Figure 1 presents the TGA curves obtained for the CNT as-received, functionalized under different conditions (CNT2510, CNT250) and further functionalized with the polymer (CNT250-PLA). The composites with polymer modified nanotubes presented smaller average agglomerate area and a narrower agglomerate area distribution. In addition, they showed improved tensile properties at low CNT concentration and presented lower electrical resistivity. Figure 2 presents the agglomerate area distribution for composites with 2 wt.% CNT with different functionalization, as well as the electrical resistivity measured for composites with different CNT contents.

References

[1] 28. Paiva, M. C.; Simon, F.; Novais, R.; Ferreira, T.; Proença, M.; Xu, W.; Besenbacher, F, ASC Nano, **4** (2010) 7379.

Acknowledgements

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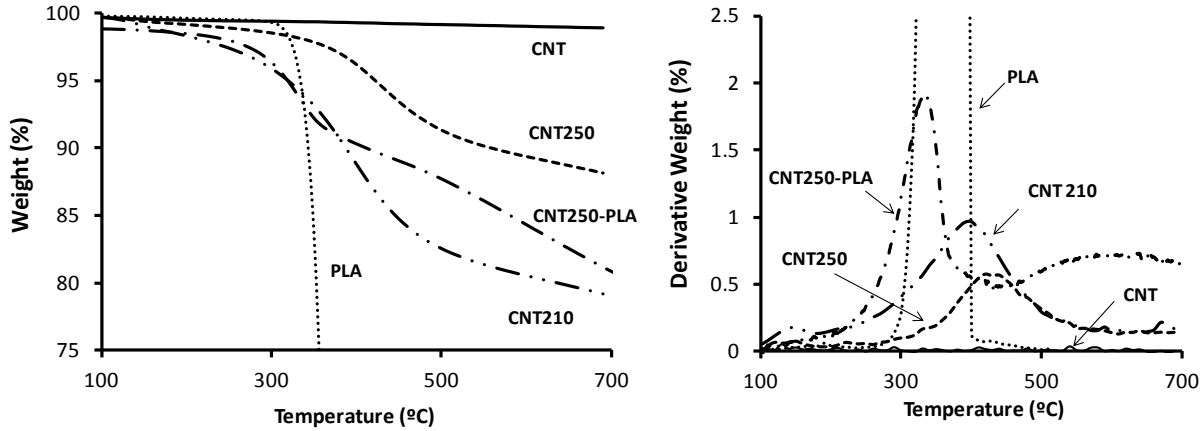

Figure 1. TGA curves of as-received CNT, functionalized CNT and PLA.

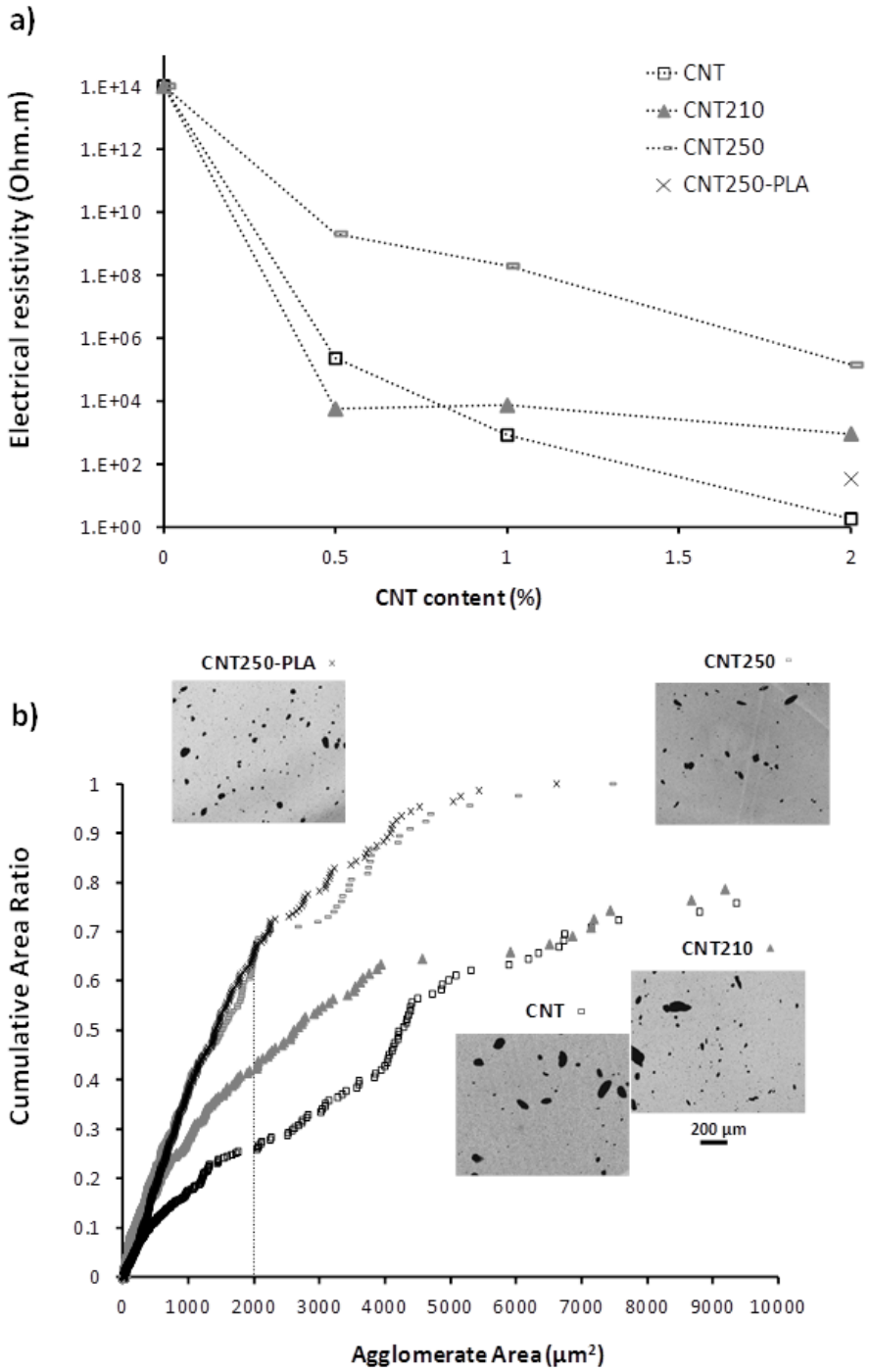

Figure 2. a) Electrical resistivity for PLA composites with non-functionalized and functionalized CNTs and b) cumulative area ratio for 2.0 wt% composites. The insert optical micrographs illustrate the observed agglomerate dispersion.