The Dispersion of exfoliated graphite nanoplatelets in polymer melts

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Abstract

Polymer nanocomposites can exhibit substantial improvement of several properties compared to the neat matrix with the incorporation of small amounts of carbon nanoparticles (CNP) such as exfoliated graphite nanoplatelets (XGnP). These graphitic nanoplatelets combine the low-cost with the electrical conductivity and high mechanical, physical and thermal properties usually exhibited by carbon nanotubes [1].

Melt mixing is probably the most common route to prepare polymer/CNP nanocomposites, even if it is still far from achieving optimal dispersion levels. However, the performance of nanocomposites depends on the level of dispersion of the nanoparticles and on their interfacial adhesion with the polymer. Chemical functionalization of the CNP surface with appropriate functional groups has been used as a means to improve interfacial adhesion [1-3]. Also, it is known that the configuration and operating conditions of the melt mixing equipment also influence dispersion [2-5].

The present work focuses on the study of the effect of surface modification on the dispersion of XGnP in polypropylene, using a prototype small-scale mixer that was designed to enable precise control of the flow conditions and monitor the evolution of dispersion. The functionalization route adopted [6,7] improved the interface between the graphite nanoplatelets and the matrix. Distribution and dispersion of the graphite nanoplatelets in the matrix were evaluated by optical and scanning electron microscopies; the change in the electrical conductivity of the composite as mixing developed was also monitored. Both dispersion and electrical conductivity improved along the length of the mixer. The mechanical properties of extruded filaments containing functionalized XGnP exhibited higher tensile modulus.

References

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Acknowledgement

We gratefully acknowledge the financial support to this research provided by FCT through project PEst-C/CTM/LA0025/2011 and PhD grant SFRH/BD/87214/2012.

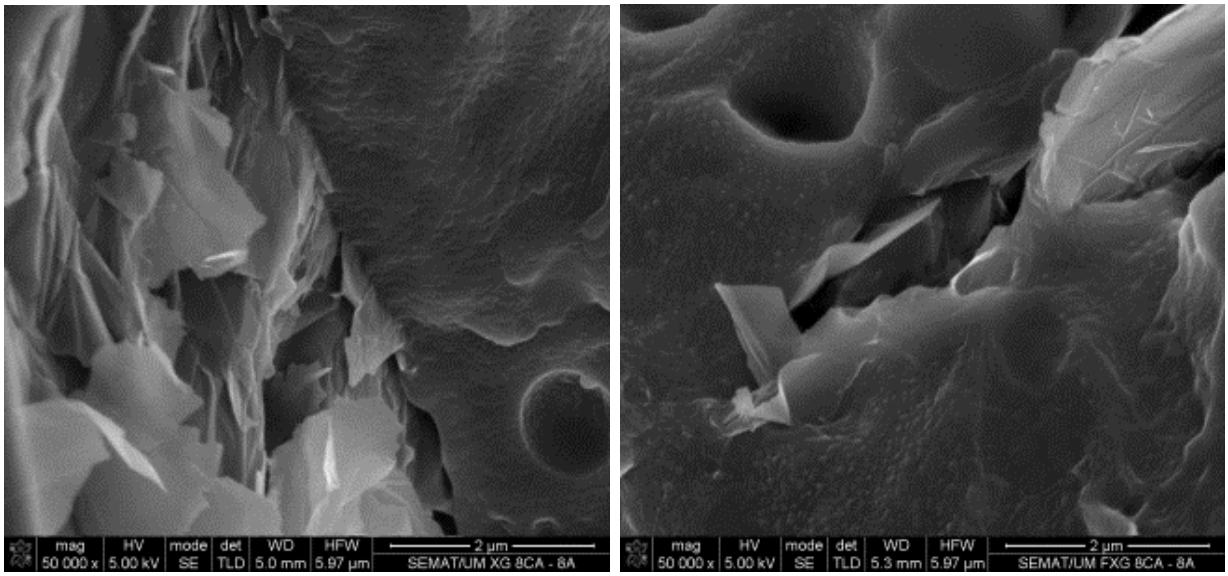

Figure 1: *Scanning Electron Microscopy images of 2wt.% of XGnP (left) and 2wt.% of functionalized XGnP (right)*