Multifunctional polymer nanocomposites with carbon nanofillers for functional and structural applications. Rheology-structure-properties relationships

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Polymer nanocomposites with carbon nanofillers are the latest trends in materials science in the recent years, but the technology of their preparation plays a crucial role in obtaining reliable materials with repeatable and enhanced properties. Up to now, there are many unresolved problems in controlling the dispersion of the nanofiller and the corresponding influence on the properties of the final nanocomposite materials. In the present study, we investigate the effects of carbon nanofillers on the dispersion process, mechanical reinforcement, and thermal properties improvement of polymer/carbon nanofiller composites. The objective is concentrated on the design of multifunctional polymer/carbon nanofiller nanocomposites and to understand the effect of carbon nanofiller on polymers at very low filler contents, below and around the flocculation threshold, and to improve the knowledge on the properties enhancement. In order to achieve this understanding, a wide range of characterization data on rheology, structure, crystallization behaviour, and thermal properties of the neat polymers and its nanocomposites, were obtained and analysed. Then, we investigated the evolution of the structure and macro-, micro-, nanomechanical and tribological properties around the flocculation threshold. Finally, a rheology-structure-property relation is established and the properties improvement is correlated to the changes of both the crystal structure and the dispersion structure of composites, as far as they determine the technology of products fabrication. Possible structural applications based on enhanced mechanical and thermal properties are bulk parts, films and as lightweight coatings in future electromagnetic shielding efficiency applications for protection of electronic nanodevices, in order to operate in severe electromagnetic environment [1]

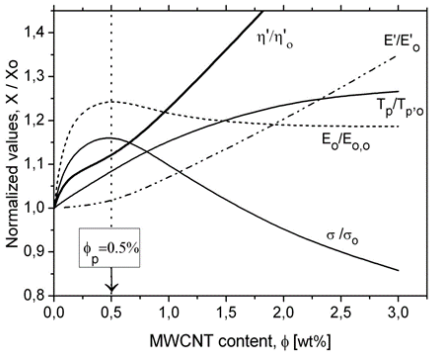

Figure 1: Improvement of the thermal and mechanical characteristics versus nanotube contents. Arrows point the flocculation threshold (fp)

References

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