Environmentally-friendly graphene-based waterborne polyurethane nanocomposites

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Abstract

The environmental awareness has been one of the reasons of increasing research and development of eco-friendly green synthesis routes for many different applications. Among others, waterborne polyurethane (WBPU) dispersions present the advantage of being synthesized by a solvent-free method, which implies low organic compound levels and non-toxicity comparing with conventional solventborne polyurethanes [1]. Furthermore, these dispersions provide the opportunity of incorporating water dispersible nanoentities enhancing or even providing additional properties. In this context, the addition of graphene has focused attention considering the reinforcing effect providing conductive properties to the final material.

In general, graphene oxide nanoentities are chosen for this type of dispersions, taking into account that the introduction of oxide functional groups favor their dispersibility in water [2]. Nevertheless, the functional groups can also act as defects points in the surface of graphene, decreasing their conductivity capacity [3]. Thereby, alternative routes for the incorporation of hydrophobic graphene to waterborne systems have become a new challenge towards the preparation of high conductive materials.

In this work, the challenge of dispersing graphene into water has been addressed through the use of biomass derived surfactants, for the subsequent preparation of nanocomposites which have been broadly analyzed in terms of thermal, mechanical, thermomechanical, morphological and conductive properties.

References

[1] Y. Li, B.A.J. Noordover, R.A.T.M. Van Benthem, C.E. Koning, Prog. Org. Coatings. 86 (2015) 134–142
[2] X. Luo, P. Zhang, J. Ren, R. Liu, J. Feng, B. Ge, J. Appl. Polym. Sci. 132 (2015) 42005/1-42005/8
[3] M. Cai, D. Thorpe, D.H. Adamson, H.C. Schniepp, J. Mater. Chem. 22 (2012) 24992–25002

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Figures

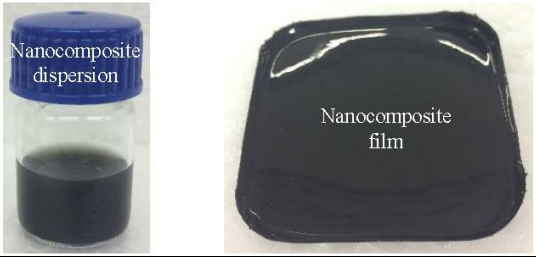

Figure 1: Graphene-based nanocomposite dispersion and film images