Mechanical Reinforcement of Graphene Oxide-Based Thermoplastic Polyurethane Nanocomposite

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Graphene oxide (GO) has been studied in the context of many applications such as mechanical reinforcement to the polymeric materials [1]. In particular, these 2D particles are able to tailor the excellent electrical, mechanical, and thermal properties of the thermoplastic polyurethane (TPU) [2]. Dispersion degree is an important factor in the properties response, which can be controlled via processing parameters and design [3]. In this work, we evaluate the efficiency of the GO reinforcement (0.25% w/w) into a TPU polymer matrix by twin-screw, melt mixing processing using different screw profiles of various degrees of shear and extensional intensity [3]. These are labelled from 1 to 4 in increasing order of mechanical intensity. Figure 1 presents the histogram of particles size for TPU/GO nanocomposites processed with the mildest and the most aggressive screw profiles. It can be seen that the particles size can be influenced by screw design of melting mixer since in the nanocomposite processed with the aggressive screw there are less agglomerates when compared to the mildest one. It may be possible that extensional flow disintegrated and / or broken the GO agglomerates in GO sheets. The tensile mechanical responses also show a significant increase in the stiffness of the TPU upon the addition of the GO particles. Finally, the viscoelastic properties in Figure 2 present an increase over the time, which indicates a change in structure of the nanocomposites at the melting point.

Acknowledgments

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References

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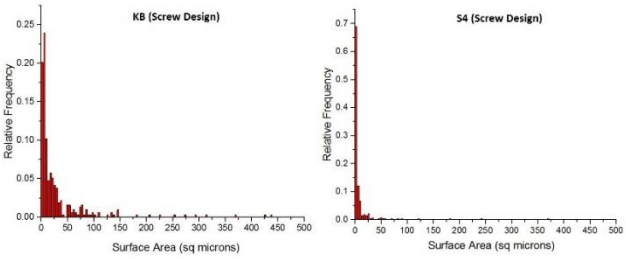

Figure 1: Histogram of particle size of TPU / GO nanocomposites obtained for two type of screw profile: a) Mild and b) Very aggressive.

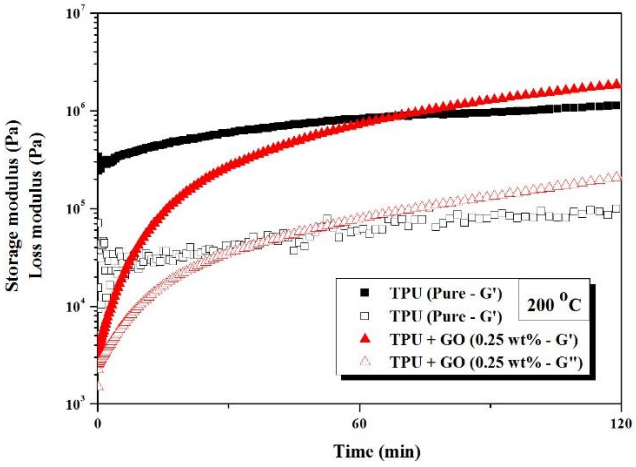

Figure 2: Viscoelastic plots of thermoplastic polyurethane (TPU) and its nanocomposite.