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Multifunctional thermoplastics using Graphene materials

The global market of thermoplastic was 242.7 million tons in 2015 and is expected to reach 296.7 million tons by 2020. This market was traditionally dominated by Europe, however in 2010, the main market is in China.
Compounding market size was estimated at 26.73 million tons in 2016. Growing substitution of metals & alloys with lightweight plastic counterparts. This market is still leader by Europe followed by North America.
Graphene materials can be used for the preparation for thermoplastic composites using 3 different techniques: insitu polymerization, solution blending and melt compounding (Figure 1). The best results for GRM-thermoplastic composites are based on the use of insitu polymerization and solution blending techniques,[1] however clear limitations in their industrial scale up and application.[2]
Melt compounding is the most used technique to produce thermoplastic composites. However, in the case of graphene materials it has some limitations such as the low retention and the discrete shear that can be applied, obtaining poor or discrete dispersion of the filler in the matrix.
Graphene materials (GRM) are a big family of materials with remarkable differences in morphology, dimensions, aspect ratio, surface chemistry, etc. An adequate selection of the GRM and processing technique is a key factor for achieves the desired properties. Also, and adequate nomenclature and standardized or industrial accepted characterization techniques are needed for the application and avoid lost of efforts and resources.
In this presentation we will compare the influence of the various graphene materials prepared by different methodologies, from LPE to oxidation/reduction, with variations in lateral size, dimension and surface chemistry and processing technologies for the preparation of composites in the final properties of the composites. Electrical and thermal conductivity, mechanical performance and fire retardancy results will be presented. Different strategies and results for the production of graphene-thermoplastic composites will be presented.

References

[1] J. Gomez, I. Recio, A. Navas, E. Villaro, B. Galindo, A. Ortega-Murguialday, J. Appl. Polym. Sci., 136 (2019), 47220.
[2] S. Haider, Y. Khan, A. Haider in, Thermoplastic Nanocomposites and Their Processing Techniques In book: Thermoplastic - Composite Materials (2012) ISBN: 978-953-51-0310-3

Figures

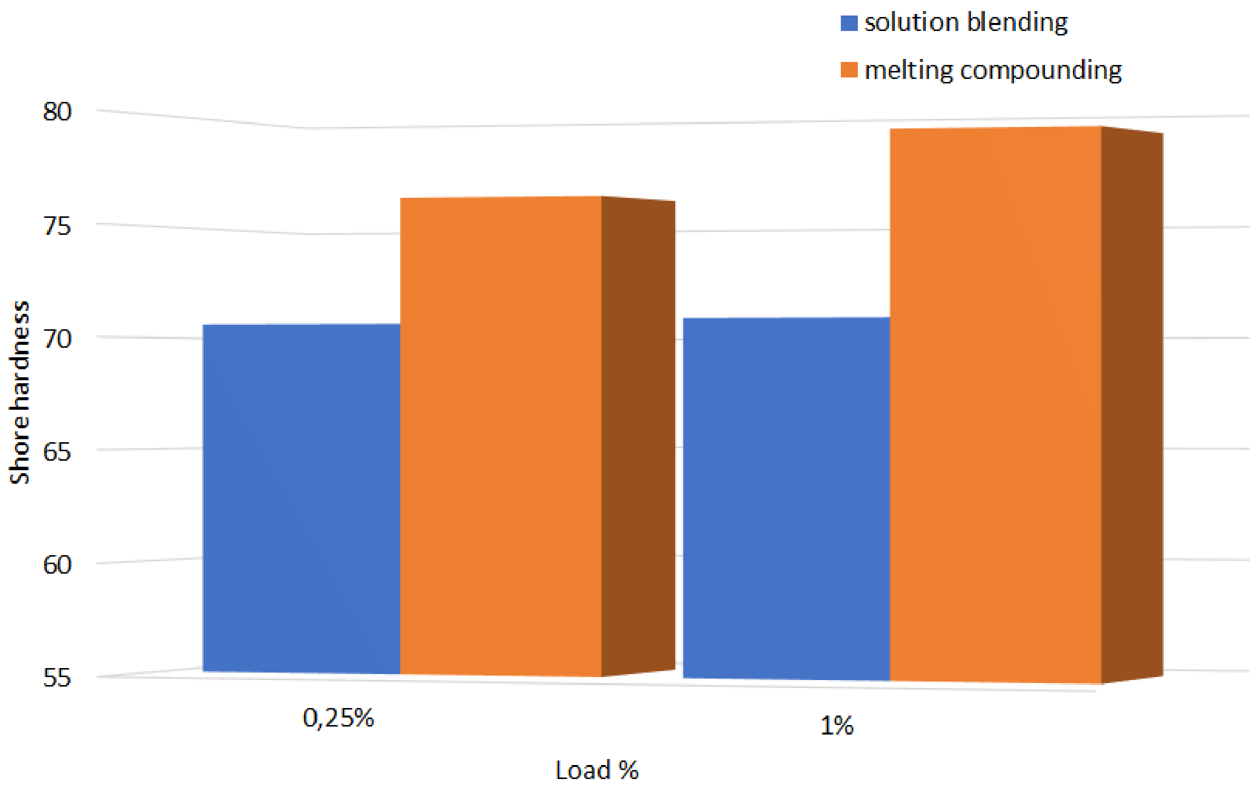

Figure 1: Shore hardness of TPU al different wt% and processing technique