Interfacial localization of reactive reduced graphene oxide in immiscible polystyrene/polylactic acid blends

Marcos Perez-Pucheta
Selene Munoz-Vargas, Karl S Coleman
Durham University, Lower Mount Joy, South Rd, Durham, United Kingdom
marcos.f.perez-pucheta@durham.ac.uk

The incorporation of inorganic nanoparticles into immiscible polymer blends provides a route to combine different properties of thermodynamic incompatible materials. This approach has practical applications such as reinforcement of the interface and improvement of the mechanical and electrical properties with a much lower amount of material. Although the localization of graphene at the interface has been previously reported, controlling the localization has proven to be difficult as it strongly depends on the blending time [1,2]. Compatibilization of immiscible blends by Reactive extrusion of different nanoparticles, including carbon nanotubes, has proven to be successful[3,4]. In this work, we report the synthesis of reduced graphene oxide (RGO) containing both epoxy groups and polystyrene chains. It is hypothesized that epoxy groups will react with the carboxy group at the end of polylactic acid chains during melt compounding. Therefore, the chemically modified RGO will preferentially be located at the interface of the blend. Compatibilization mechanism proposed is supported by SEM and TEM imaging as well as rheological data.

References

[1] L. Bai, R. Sharma, X. Cheng and C. W. Macosko, Langmuir, 34 (2018) 1073–1083
[2] L. Bai, S. He, J. W. Fruehwirth, A. Stein, C. W. Macosko and X. Cheng, *J. Rheol. (N. Y. N. Y).*, 61 (2017) 575–587
[3] H. Wang, X. Yang, Z. Fu, X. Zhao, Y. Li and J. Li, Macromolecules, 50 (2017) 9494–9506
[4] X. Zhao, H. Wang, Z. Fu and Y. Li, ACS Appl. Mater. Interfaces, 10 (2018) 8411–8416

Figures

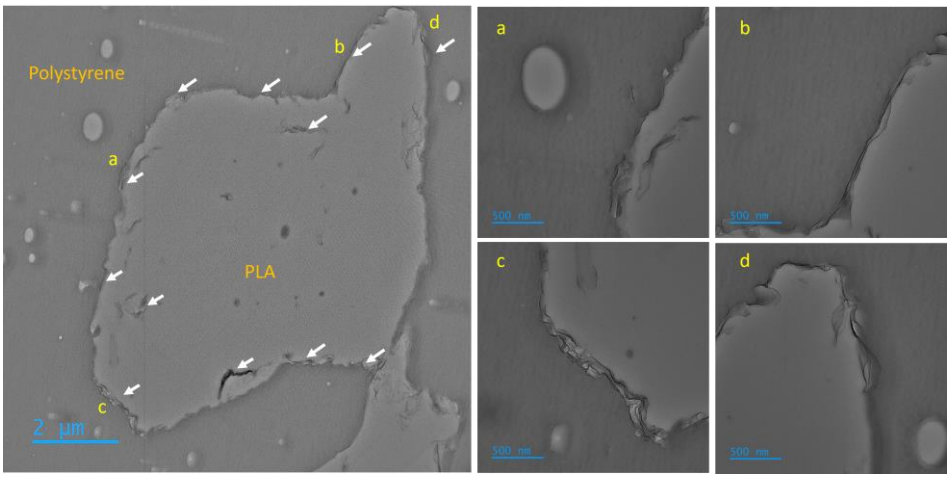

Figure 1: Transmission Electron Microscopy (TEM) image of an ultramicrotomed sample with 3wt % reactive graphene oxide showing its interfacial localization