rGO-nanocomposite compounding for use in fused deposition modelling

Siamak Eqtesadi[1]
Azadeh Motealleh[1], Rune Wendellbo[1], Marco Scatto[2], Paolo Scopece[2], Alessandro Patelli[2], Michele Sisani[3] ,Maria Bastianini [3], Hugo Perera[4] Lorenzo Moroni[5]
[1]*Abalonyx AS, Forskningsveien 1, 0373 Oslo, Norway*
[2]*Nadir Srl, Via Torino 155b, c/o Università Cà Foscari Venezia, I-30172 Mestre (VE), Italy*
[3]*Prolabin & Tefarm, Via dell'Acciaio, 9, 06134 Perugia, Italy*
[4]*Universidad de Extremadura, Escuela de Ingenierías Industriales, Badajoz, Spain*
[5]*Maastricht University, Universiteitsingel 40, 6229ER Maastricht, the Netherlands*
se@abalonyx.no

Abstract

Polymers are widely used as biomaterials for the fabrication of medical device and tissue-engineering scaffolds. However, most of polymers may not completely meet the requirements for some applications due to their insufficient mechanical and biological properties. The incorporation of an inorganic phase into the polymeric matrix can ideally improve not only the mechanical properties of the material, but also its bioactivity [1]. Graphene derivatives can be used as a promising additive in polymer matrices to their enhance bioactivity and mechanical properties.

In addition to selecting the proper materials for scaffolds, choosing also the right fabrication method could be a challenge to meet the requirements needed for an ideal scaffold.

Additive manufacturing technologies, such as Fused Deposition Modelling (FDM),, opened new doors for fabricating 3D composites with complex shapes. The incorporation of graphene derivatives such as graphne oxide (GO) and reduced graphene oxide (rGO) is not an easy task. Mixing GO in a molten polymer is problematic due to thermal reduction of GO at high temperatures, which results in the formation of carbonaceous gases. On the other hand rGO is not easily dispersible due to its aggregated nature.

We solved these aforementioned problems through two different approaches.

This work reports the activities of Abalonyx in an EU project entitled *"FAST, H2020-NMP-PILOTS-2015", under grant agreement n° 685825.*

References

[1] T. Kasuga, H. Maeda, G. Jell, I. Notingher, and L. Hench, "Preparation of vaterite/poly(lactic acid) composites with excellent apatite-forming ability," Bioceram. 17, vol. 17, pp. 449–452, 2005.

Figures

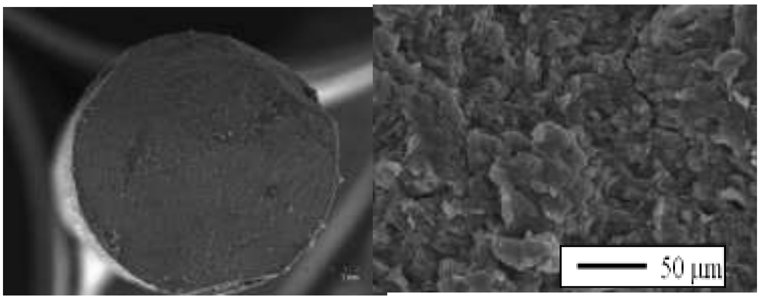

Figure 1: SEM micrographs of filaments with 10 wt.% rGO.

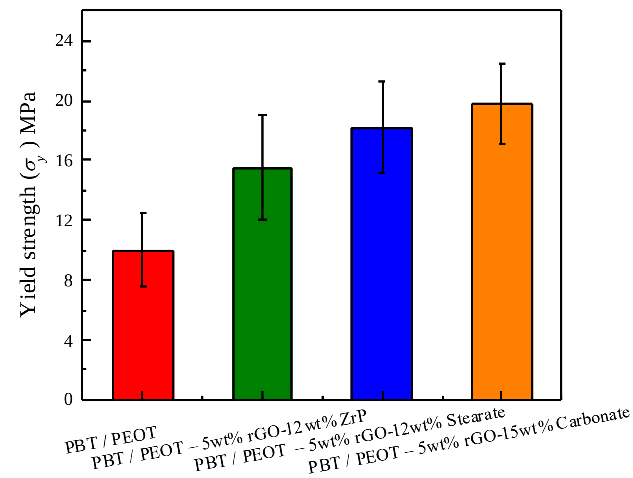

Figure 2: Evolution of compressive strength resulting from addition of different nanofillers.