The potential of graphene oxide and reduced graphene oxide in fabrication of 3D printed ceramicand polymeric composites

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Graphene, a monolayer of carbon atoms arranged in a honeycomb lattice, has shown impressive thermal, mechanical, and electrical properties, and is a promising alternative as a reinforcement to tailor the material structure at nanometre scale in order to obtain stronger and tougher engineering composites.

Additive manufacturing method (AMM), has opened new doors for fabricating 3D composites with complex shapes. Robocasting and Fused deposition Modelling (FDM) are examples of commonly used AMMs[1].

The current Work reports the use of graphene-like nanoplatelets to enhance the mechanical performance of scaffolds made of ceramics and polymers matrices, fabricated by robocasting and FDM, respectively. These composites have a wide range of application including high wear components, nuclear reactors, light-weight armor and biomedicine. According to our results, it was found that the addition of GO platelets up to 2 vol.% content enhanced the mechanical performance of the ceramic scaffolds in terms of strength and specially toughness. Moreover, addition of 5 vol. % to polymeric matrix resulted in 80% improvement in the compressive strength.

References

[1] S. Eqtesadi, A. Motealleh, P. Miranda, A. Lemos, A. Rebelo and J.M.F. Ferreira, Mater. Lett. 93 , pp. 68-71, (2013).

Figures

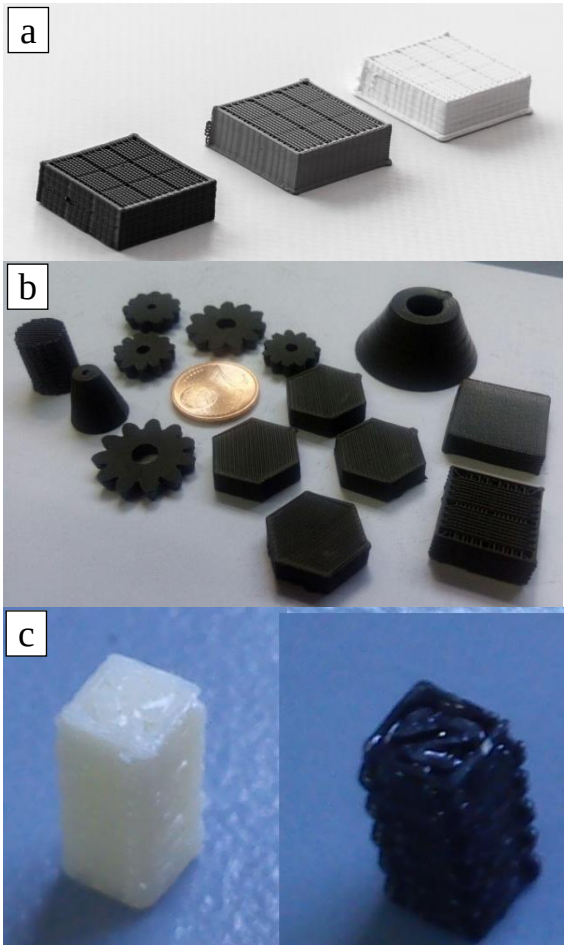

Figure 1: Optical images of 3D porous and dense scaffolds produced by robocasting. (a) Bioglass/rGO composites. (b) B4C/rGO with different shapes and (c) PLA and PLA/rGO scaffolds printed by FDM. The difference in the color is due to presence of rGO in the structures.