ZnO decorated laser-induced graphene produced by direct laser scribing

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Zinc oxide/laser-induced graphene (ZnO/LIG) composites were successfully produced, for the first time, by a simple, fast and cost-effective single-step approach [1]. In order to overcome the usual elaborated and time-consuming preparation techniques, a direct laser scribing (DLS) methodology was employed by irradiating a metallic zinc/ZnO-covered polyimide with a CO2 laser under ambient conditions. In this way, ZnO decorated LIG structures are produced. Since the formation of LIG and ZnO takes place simultaneously, a stronger link and interaction between the two materials is expected when compared with other approaches. The produced samples exhibited the presence of both wurtzite-ZnO and sp2 carbon, as well as the typical ZnO-related photoluminescence properties, whose features can be tuned depending on the laser processing conditions and the nature of precursors used, highlighting their influence on the composites' optical defect distribution. The sample produced from the ZnO-based precursor evidenced the highest luminescence signal, with a dominant UV recombination. Electrochemical measurements point to the existence of charge transfer processes between LIG and the ZnO particles. Additionally, this method allows to perform a patterned design by using a computer-assisted laser-scribing system, also prone to easy scalability. As the processing conditions can be chosen to keep a thin polymer sheet as mechanical substrate, flexible samples can be produced, which makes these composites attractive for many applications. For instance, they present interesting properties to be applied as transducer platforms for optical and electrochemical sensing devices for detection of biological analytes.

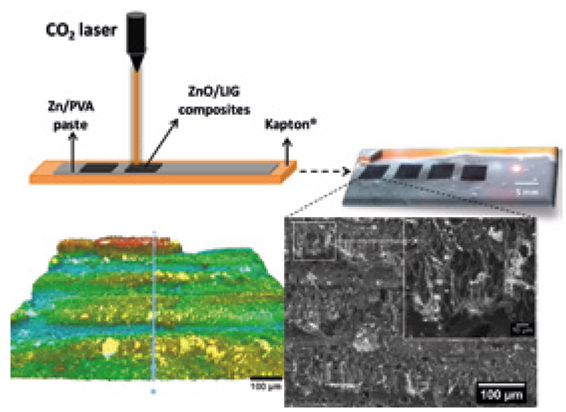

FIGURE 1
Schematic illustration of the laser-scribing process with a representative topographical profile and a scanning electron microscopy image of the ZnO decorated LIG [1]

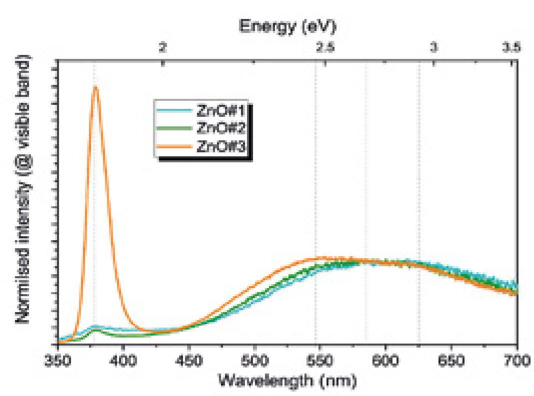

FIGURE 2
Photoluminescence spectra obtained by exciting the samples with the 325 nm laser line for samples processed in different experimental conditions [1].

[1] J. Rodrigues, J. Zanoni, G. Gaspar, A.J.S. Fernandes, A.F. Carvalho, N.F. Santos, T. Monteiro, F.M. Costa, Nanoscale Adv. 1 (2019) 3252–3268. doi:10.1039/C8NA00391B.