In situ growth of silver sulfide nanocrystals onto graphene oxide flakes: synthetic, spectroscopic and photocatalytic studies

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Graphene based materials have emerged as promising materials in many technologies due to their structure-dependent physical and chemical properties [1]. Metal chalcogenide nanocrystals have also attracted great attention because of their size-dependent properties and their potential application in diverse areas, which include sensors, solar cells, catalysts and optoelectronic devices [2]. For example, Ag₂S (Eg= 1.08 eV) has been reported to harvest photons efficiently in the visible spectral region, which makes this semiconductor an interesting material to be explored in visible light photocatalysis.

The combination of the above types of nanomaterials can be regarded as a promising strategy to develop efficient photocatalysts for water treatment technologies [3]. However, there are few synthetic routes that result in morphological uniform hybrid materials comprising both components, which in some cases can be related to lack of knowledge about surface chemical effects on the synthesis itself. Hence, in this research we have studied the in situ growth of Ag₂S nanocrystals, in the presence of graphene oxide (GO) flakes dispersed in ethanol, by the sonolytic degradation of a Ag(I) dialkyldithiocarbamate complex [4]. Several synthesis parameters have been investigated in order to optimize experimental conditions for obtaining morphological uniform hybrid nanomaterials. In particular, Raman spectroscopic methods have been applied to monitor the surface nature of GO obtained from the exfoliation of graphite, due to their potential impact on the nucleation and growth of the metal sulfide nanophases onto the GO surfaces. Preliminary experiments aiming the evaluation of the photocatalytic activity of the as prepared hybrid materials were carried out, by using an organic dye as the water contaminant model and a visible light photoreactor.

Acknowledgements This research was financed in the scope of the FCT Project UTAPICDT/CTMNAN/0025/2014 and through the project CICECO-Aveiro Institute of Materials, POCI-01-0145-FEDER-007679 (FCT Ref. UID /CTM /50011/2013), financed by national funds through the FCT/MEC and when appropriate co-financed by FEDER under the PT2020 Partnership Agreement. Ana C. Estrada also thanks FCT for a post-doctoral grant (SFRH/BPD/86780/2012).