

Graphene double functionalization with xanthates and peroxides

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Abstract

Carbon nanotubes and graphene have emerged as promising nanocarbon (nC) materials in various fields. However in order to benefit from their full potential, a functionalization step is usually required. For this reason, different covalent and non-covalent derivatization methods have been developed in the last few years. In this context, we have found a new functionalization method that consists in the grafting of xanthates at nanocarbon surfaces. This covalent grafting strategy implies the use of a peroxide as radical initiator and leads to the formation of new C-C and C-S bonds (Figure 1) [1,2].

The presence of xanthates at carbon nanotubes and reduced graphene oxide (rGO) surfaces has been highlighted by X-ray photoelectron spectroscopy, bulk elemental analysis and secondary ion mass spectrometry. The covalent nature of the bond between the nanocarbon sp^2 skeleton and the organic fragments has been shown by Raman spectroscopy and thermogravimetric analysis.

After covalent anchoring, grafted fragments have been post-functionalized. Sulphured fragments were reduced in thiols as nucleation sites for gold or platinum species to prepare nanocarbon-supported nanoparticles^[3]. Moreover, different R^1 fragments such as activated esters and phthalimides have been grafted and post-functionalized to create amide bonds with diverse organic ligands to immobilize homogeneous catalysts.

Finally, experiments implying heteroatom-containing peroxides have been performed. These have highlighted the grafting of the peroxide at the nC surface along with the xanthate. The method proposed here is therefore an easy way to obtain doubly functionalized nC in one single step.

References

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[2] F. Pennetreau, O. Riant, S. Hermans, *Chem. Eur. J.*, **20** (2014) 15009.
[3] D. Marquardt, F. Beckert, F. Pennetreau, F. Tölle, R. Mülhaupt, O. Riant, S. Hermans, J. Barthel, C. Janiak, *Carbon*, **66** (2014) 285.

Figures

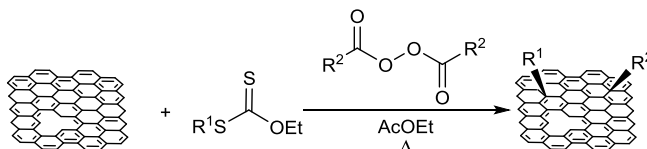


Figure 1 : Schematic representation of rGO double functionalization with R^1 from a xanthate and R^2 from a peroxide (minor S-containing functions omitted for clarity).