

Colloidal Nanoparticles Decorated Graphene based Materials: New Functional Nanocomposites

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Graphene (G) is an extraordinary material for advanced devices, due to its superior electrical conductivity, (electro)catalytic activity and surface chemical reactivity. The last enables the implementation of non-covalent routes for its decoration with inorganic nanostructures, thus resulting in hybrid nanocomposites exhibiting an original ingenious combination of the properties of G and of the inorganic components. Nanoparticles (NPs) prepared via colloidal chemistry approaches possess original size- and shape-dependent properties and are particularly suited for decorating G [1,2], thanks to the possibility to engineer their surface chemistry. Nanocomposites based on graphene based materials and different types of colloidal NPs, PbS, TiO₂ and Au, respectively, [1-3] have been prepared and thoroughly investigated, from a morphological, spectroscopic, electrical and (photo)electrochemical points of view. Distinct decoration approaches have been used, both for immobilizing pre-synthesized inorganic NPs onto the G based structures, and for performing *in situ* synthesis. In both strategies suitable anchoring molecules have represented key element to enable a close interaction between G and NPs and thus direct the chemical and electronic properties of the resulting hybrids. In all the investigated systems a controlled and uniform NP coverage has been obtained. The different obtained materials have been studied and their photoactivity and photoelectrochemical behavior have demonstrated that this class of hybrid nanocomposites hold a great promise for photo conversion, (photo)catalytic and sensing applications [4-6]. Selected examples of nanocomposites will be described and their possible integration in devices presented.

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References

- [1] C. Ingrosso, M. Corricelli, A. Disha, E. Fanizza, G. V. Bianco, N. Depalo, A. Panniello, A. Agostiano, M. Striccoli, M. L. Curri (2019) *Carbon*, 152, 777-787.
- [2] C. Ingrosso, G. V. Bianco, M. Corricelli, R. Comparelli, D. Altamura, A. Agostiano, M. Striccoli, M. Losurdo, M. L. Curri, G. Bruno (2015) *ACS Applied Materials & Interfaces* 7 (7), 4151–4159.
- [3] C. Ingrosso, M. Corricelli, F. Bettazzi, E. Konstantinidou, G. V. Bianco, N. Depalo, M. Striccoli, A. Agostiano, M. L. Curri, I. Palchetti (2019) *J. Mater. Chem. B.*, 7, 768-777.
- [4] F. Bettazzi, S. Laschi, D. Voccia, C. Gellini, G. Pietraperzia, L. Falciola, V. Pifferi, A. Testolin, C. Ingrosso, T. Placido, R. Comparelli, M. L. Curri, I. Palchetti (2018) *Electrochimica Acta*, 276, 389-398.
- [5] C. Ingrosso, G. V. Bianco, V. Pifferi, P. Guffanti, F. Petronella, R. Comparelli, A. Agostiano, M. Striccoli, I. (2017) *J. Mater. Chem. A*, 5, 9307

Figure

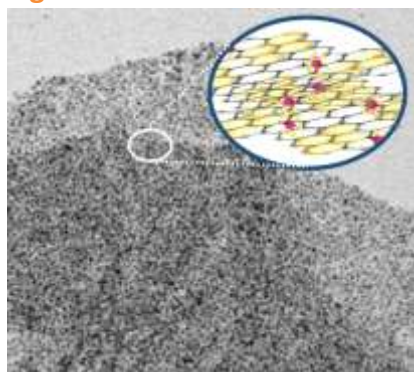


Figure 1: TEM micrograph of a solvent dispersible nanocomposite based on reduced graphene oxide (RGO) *in situ* decorated with Au NPs. In the inset sketch of the anchor molecules mediated interactions between RGO based material and Au NPs.