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, TiO_2 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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Figure

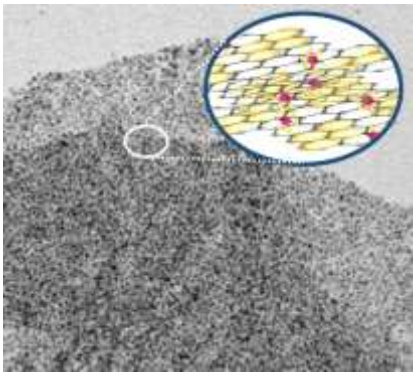

Figure 1: TEM micrograph of a solvent dispersible nanocomposite based on reduced graphene oxide (RGO) *in situ* decorated with Au NPs. In the inset sketch of the anchor molecules mediated interactions between RGO based material and Au NPs.