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REVEALING SUPRAMOLECULAR INTERACTIONS IN GRAPHENE-CHITOSAN COMPOSITES

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INTRODUCTION

Graphene-chitosan composites have been developed to implement the use of graphene in bioapplication as the opto-electronic and structural properties of graphene excel from many other materials. [1-3]

On the other hand, chitosan excels as an excellent biocompatible material able to create film-coatings on the surface of the substrate material. [4] However, much less is known about the physico-chemical and supramolecular interactions between the graphene and chitosan acting as a bio-compatible organic composite.

We studied the physical, structural and electronic characteristics that interact along with the formation of a homogeneous graphene-chitosan composite material. We conducted an experimental plus theoretical study of both systems to disclose the supramolecular influence between the graphene functionalization with the chitosan along the deposition of silver and gold nanoparticles on the graphene-chitosan surface revealing a preferential interaction of Au with the graphene-chitosan compound in contrast to the deposition of Ag.

This nanostructured composite may serve to develop advanced materials that could be implemented in upcoming biomedical applications.

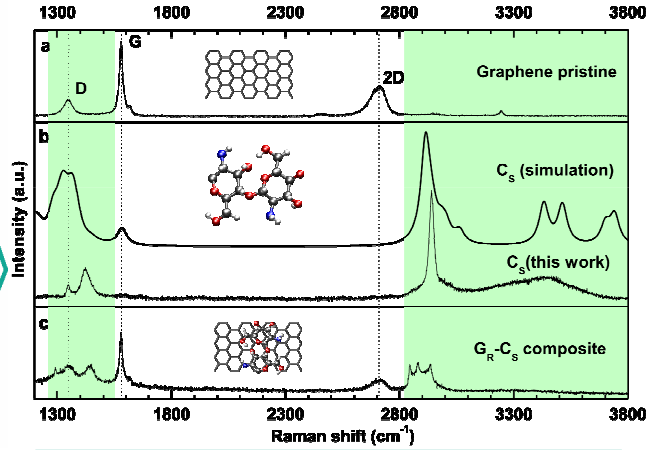

FIG. 1 Raman evolution of the interaction between graphene and chitosan (70% deacetilated) to from a Gr-Cs composite compared to the expected theoretical Raman bands in chitosan at 100% of deacetilation.

Surface functionalization monitoring

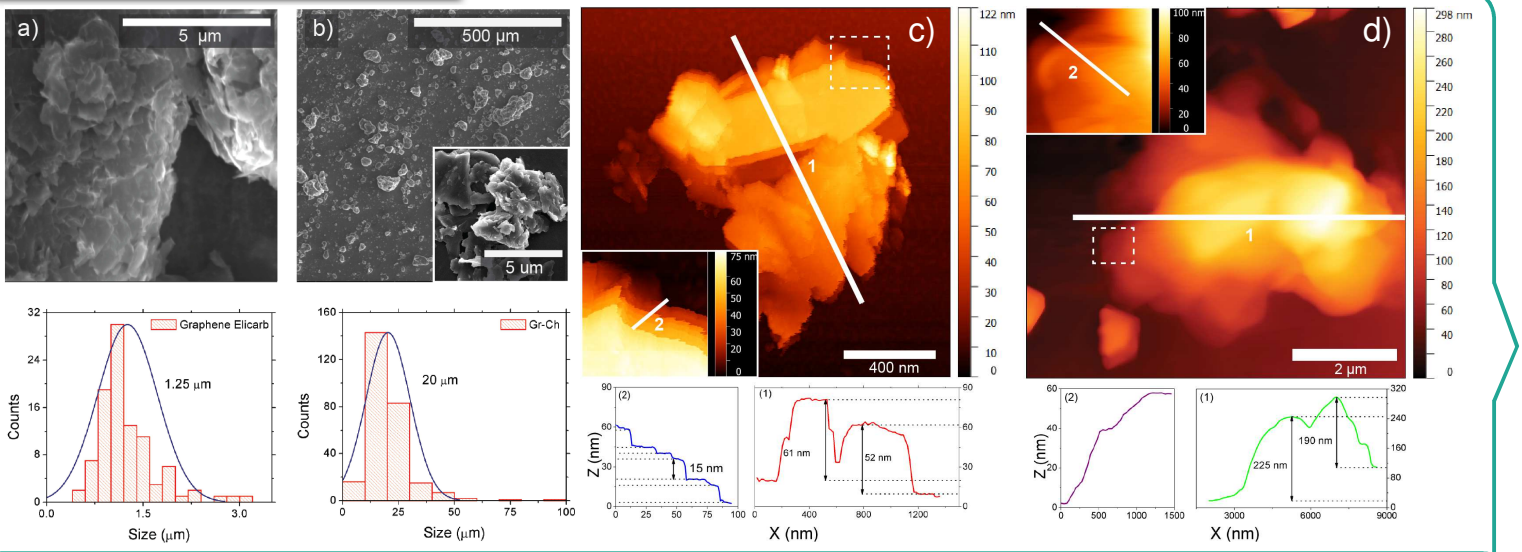

FIG. 2 Scanning eletron microspy of: a) graphene pristine (Eicarb), b) graphene-chitosan composite, (bottom) Statistical size distributtion of the flakes are shown. AFM images of: a) pristine graphene flakes from Elicarb, and b) graphene-chitosan (Gr-Cs) composite flakes. A profile analysis from each AFM analysis is shown to prove: (i) the initial number of graphene layers in the pristine material (~10 layers), and (ii) the morphological surface change derived from chitosan coverage around the multilayer graphene flakes.

DFT functionalization monitoring & Decoration with NPs

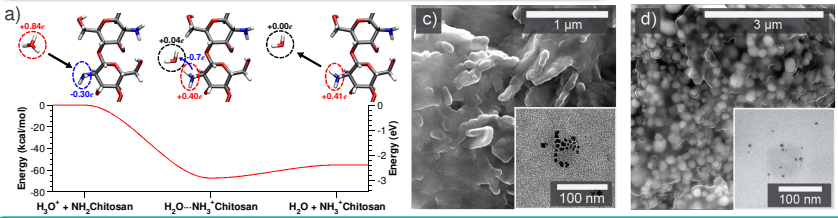

FIG. 3 a) Structures, charge transfer, and energetic profile for the chitosan protonation reaction involved within the graphene-chitosan composite formation. SEM imaging between the composite and: c) gold and d) silver nanoparticles.

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