Revealing supramolecular interactions in graphene-chitosan composites

Dr. Julio C. Chacón-Torres
Lorena Layana, Charlotte Berrezueta-Palacios, Lenin Andres Guerrero-León, Duncan John Mowbray, and Sarah Briceño
School of Physical Sciences and Nanotechnology, Yachay Tech University, Urcuquí 100119, Ecuador
jchacon@yachaytech.edu.ec

Graphene-chitosan composites have been developed to implement the use of graphene in bioapplications. For instance, the opto-electronic properties of graphene excel from many other materials in addition to its intrinsic structural strength. [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.

Here have studied the physical, structural and electronic characteristics that interact along with the formation of a homogeneous graphene-chitosan composite material. We have conducted an experimental plus theoretical study of both systems to disclose the supramolecular influence between the graphene functionalization with the chitosan molecules to form the composite. The study includes a full panorama of the molecular interactions by means of Raman and Fourier transform infrared (FTIR) spectroscopies; atomic force (AFM), scanning electron (SEM) and transmission electron (TEM) microscopies; in addition to density functional theory (DFT) calculations that explain the functionalization mechanism in graphene-chitosan composites. Finally we deposited 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.

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FIGURES

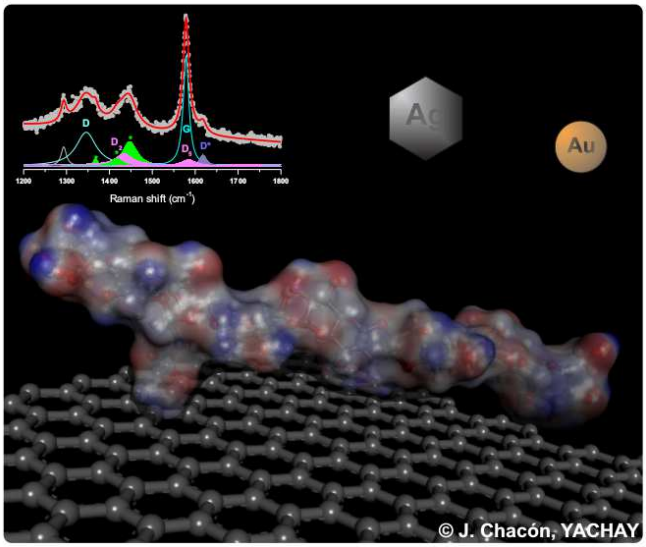

Figure 1: Schematic representation of the molecular interaction between a chitosan molecule on graphene when Ag and Au nanoparticles interact. The Raman spectrum represents the vibronic response of the chitosan-graphene composite.