Doping and reduction process analysis in graphene oxide- gold nanoparticle hybrids probed by Raman spectroscopy mapping

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Abstract

The growing demand for graphene and graphene oxide nanocomposites decorated with nanoparticles is caused by their future applications. Reduction process and doping are two main effects appearing in graphene oxide- gold nanoparticle hybrids (GO-Au) that have an impact on the electronic, optical and chemical properties. We propose the systematic study of Raman spectroscopy mapping mode and statistical analysis which allows for a precise examination of these effects in the hybrid structure. The shifts in the distribution of the position of D and G Raman peaks as well as their cross-correlation provide evidence of a change in doping level which has also confirmed by electrical measurements. We present analysis of GO reduction upon gold nanoparticles addition which is reflected by the upshift of the statistical distribution of G and D peaks (ID/IG) intensity ratio and shifts of main Raman modes. In addition the reduction process was further confirmed by FTIR spectroscopy where GO spectrum showed a decrease in the intensity of the 1650 cm⁻¹ and 1280 cm⁻¹ bands and changes in groups connected with the carbon ring.

Figure 1: Evolution of the ID/IG ratio and peaks position of GO upon gold nanoparticles addition.

Figure 2: FTIR spectra of GO and GO with gold nanoparticles.