

## **Au NPs on graphene: influence of the deposition method on the doping effect**

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Modifying in a controlled way the electronic properties of graphene (often denoted as band engineering) is fundamental to create functional devices based on this material. This field has experienced an increased activity in the last few years as properties such as the carrier concentration and mobility can be tuned by depositing different kind of chemical species onto graphene, intercalating atoms in its structure or by simply changing the substrate where graphene is deposited on [1,2,3].

In this work we focus on the doping of graphene with gold nanoparticles (NPs), deposited using two different methodologies. The first one is a chemical doping, based on the formation of Au NPs from a solution containing HAuCl<sub>4</sub> [4,5], in which the doping mechanism involves charge transfer between the Au ions and the graphene. The second procedure consists on Au NPs deposition by means of a sputter gas aggregation source in ultra-high vacuum (UHV), in which the doping procedure relies mainly on the electrostatic interaction between NPs and graphene.

Kelvin Probe Microscopy (KPM) measurements have been performed to study the modification of the surface potential as a function of Au NPs coverage for both series of samples, and explore its possible relation with parameters such as mobility and carrier concentration, extracted from macroscopic resistivity measurements. First-principles calculations have been carried out for varying Au NPs sizes and concentrations to understand the differences experimentally observed.

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