**Structural and electronic properties of graphene grown on Cu(111) and on Au(111) surfaces by ethylene irradiation.**

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## Abstract

A novel technique for growing graphene on relatively inert metals is presented in this work [1]. By this route, consisting in the thermal decomposition of low energy ethylene ions irradiated on hot metal surfaces in ultrahigh vacuum (UHV), high quality graphene monolayers have been grown on Cu(111) and, for the first time, on Au(111) single crystals (fig. 1). These samples have been characterized by means of scanning tunneling microscopy (STM), low energy electron diffraction (LEED), and Auger spectroscopy (AES). The results provided by all these techniques reveal the formation, on the Cu(111) and Au(111) surfaces, of carbon monolayers exhibiting a long range ordering in a honeycomb lattice. At this point, it is important to remark that the quality of these graphene monolayers grown on Cu(111) by the method presented here is similar to that obtained by more traditional methods. Additionally, it has allowed the epitaxial growth of graphene monolayers on Au(111), a quite inert surface where graphene had not been grown until now.

Moreover, these graphene monolayers grown on Cu(111) and Au(111) single crystals have served us as a platform for the study of the graphene-metal interaction for both surfaces. The results obtained by STM and scanning tunneling spectroscopy (STS) are compared with existing ones on other graphene like systems where the graphene-substrate interaction is weak [2-4]. In particular, for both noble metal substrates, but specially for Au(111), our STM and STS measurements provide sound evidence of a very weak graphene-metal interaction.

## References

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**Figures**

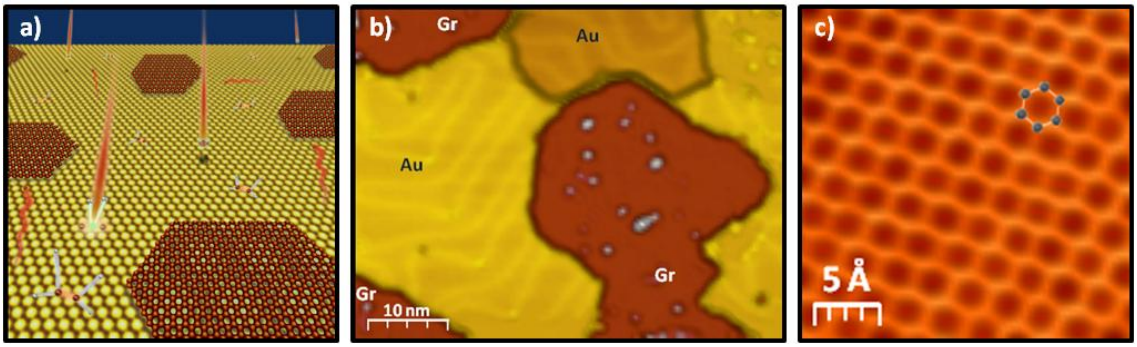


**Figure 1. a)** Schematic representation of the new method for growing graphene. **b)** STM image of an area of 53 x 41 $nm^2$ exhibiting three graphene flakes epitaxially grown on a Au(111) surface. The herringbone reconstruction characteristic of the Au(111) surface can be observed. Tunneling parameters: Vs = 500 mV, $I_T$ = 0.5 nA. **c)** STM image over a defect-free graphene/Au(111) area displaying the honeycomb structure. Tunneling parameters: Vs = 30 mV, $I_T$ = 21 nA; size: 2.5 x 2.5 $nm^2$.