Double maximum resistance induced by hydrogen gas exposition in graphene devices

Cíntia Lima Pereira  
*Universidade Federal de Minas Gerais*

Alisson Roniere Cadore  
*University of Cambridge*

Natália Pereira Rezende  
*Universidade Federal de Minas Gerais*

Leonardo C. Campos  
*Universidade Federal de Minas Gerais*

Rodrigo Gribel Lacerda  
*Universidade Federal de Minas Gerais*

In this work, we study the interaction of molecular hydrogen with graphene devices. Our experiments demonstrate that H2 interacts not at the graphene channel but at the metallic contacts and that this interaction is strongly dependent on the type of metallic contact used. The H2 gas is a highly volatile and combustible gas, therefore, development of stable sensors under different temperature and pressure conditions are still heavily researched. Previous works have studied graphene-contact interaction, showing that the difference of the working function between them generate a local p-type or n-type doping [1]. Thus, in addition to the electrostatic doping generated by the back gate voltage, pn junctions is form that extends through the conduction channel. Cadore, A. and collaborators verified that the H2 can modulate these pn junctions between graphene-contact [2]. Another study also showed a n type doping in the presence of hydrogen, manifested by the displacement of the charge neutrality point to more negative back gate voltage values [3]. Here, we present a new way of inducing the decoupling of the work function between metal-graphene, where, the resistance as function of gate voltage curves take the double resistance peak (M-shape) when the devices are exposed to molecular hydrogen. The phenomena was observed for different temperatures and gas concentrations. We also show that this effect is reversible and depends on the contact geometry. The high variation of the resistance generated by the emergence of the second peak and the low time of response to hydrogen allows the application of this devices in H2 detection. References: [1] G. Giovannetti, at ala. Physical Review Letters, vol. 101, n. 026803, pp. 1-4, 2008. [2] A. R. Cadore, at all. Applied Physics Letters 109, n. 033109, pp. 1-5, 2016. [3] B. H. Kim, at all. Scientific Reports, vol. 2, n. 690, 2012.