Spin orbit effects in the electronic transport properties of adsorbed graphene nanoribbons

W.Y. Rojas
Universidade Federal do ABC, Santo André, SP, Brazil.

A. F azzio, A.J.R. Da Silva
Universidade de Sao Paulo, Sao Paulo, Brazil.

S. Sanvito
School of Physics and CRANN, Trinity College Dublin, Dublin 2, Dublin, Republic of Ireland.

A.R. Rocha
Instituto de Física Teórica , Universidade Estadual Paulista - Júlio de Mesquita Neto, Sao Paulo, Brazil

Graphene has received great attention due to its exceptional properties, which include corners with zero effective mass, extremely large mobilities, this could render it the new template for the next generation of electronic devices. Furthermore it has weak spin-orbit interaction because of the low atomic number of carbon atom in turn results in long spin coherence lengths. Therefore, graphene is also a promising material for future applications in spintronic devices - the use of electronic spin degrees of freedom instead of the electron charge. Graphene can be engineered to form a number of different structures. In particular, by appropriately cutting it one can obtain 1-D system -with only a few nanometers in width - known as graphene nanoribbon, which strongly owe their properties to the width of the ribbons and to the atomic structure along the edges. Those GNR-based systems have been shown to have great potential applications specially as connectors for integrated circuits. Impurities and defects might play an important role to the coherence of these systems. In particular, the presence of transition metal atoms can lead to significant spin-flip processes of conduction electrons. Understanding this effect is of utmost importance for spintronics applied design. In this work, we focus on electronic transport properties of armchair graphene nanoribbons with adsorbed transition metal atoms as impurities and taking into account the spin-orbit effect. Our calculations were performed using a combination of density functional theory and non-equilibrium Greens functions. Also, employing a recursive method we consider a large number of impurities randomly distributed along the nanoribbon in order to infer, for different concentrations of defects, the spin-coherence length.