PROXIMITY-INDUCED SPIN POLARIZATION OF GRAPHENE IN CONTACT WITH HALF-METALLIC MANGANITE

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Graphene has attracted great attention in spintronics due to their high potential for spin polarized transport arising from their small spin-orbit coupling, vanishingly small hyperfine interaction and excellent charge carrier mobility. However, despite considerable efforts in recent years, it still remained challenging to efficiently manipulate the spins of the conduction electrons in graphene-based devices. Proximity contacts with magnetic oxides are of current interest from the expectation of the induced spin polarization as well as weak interactions at the graphene/magnetic oxide interfaces for efficient spin polarized injection. Here, we provide a direct evidence for the magnetic proximity effect in the junctions of single layer graphene and half-metallic manganite $La_{0.7}Sr_{0.3}MnO_3$ (LSMO). In the current study we have employed the spin-polarized metastable deexcitation spectroscopy (SPMDS) technique with extremely high surface sensitivity and successfully demonstrated that at the graphene/manganite interface, a large spin polarization is induced in the graphene p-band that is independent of the chemical environment around graphene [1]. LSMO with (001) orientation, with the *c*-axis out-of-plane and LSMO with (110) orientation, with the *c*-axis in-plane with different termination layers of the LSMO poses different chemical environments and electronic wavefunctions for the first deposited layer of graphene. This allow us to clarify whether the observed spin polarization is due to chemical interaction or due to proximity effect of the magnetic oxide. The results clearly show evidence for the magnetic proximity effect in the single layer graphene (SLG)/LSMO interface. It is demonstrated that graphene p-band in the SLG/LSMO junction is spin-polarized along the spin polarization direction of LSMO in a broad energy range below the Fermi level. The spin polarization in the vicinity of the Fermi level is significantly higher in SLG/LSMO junctions compared to that at the LSMO surface. Achievement of a highly spin-polarized surface by application of a single layer graphene sheet on top of half-metallic LSMO, could be proven a very effective way to enhance interface spin polarization of hybrid spintronic devices.

[1] S. Sakai, S. Majumdar et al., ACS Nano 10 (2016) 7532.