Magnetism in graphene capped ultra-thin cobalt

C.A. Brondin[1], S. Ghosh[2], F. Genuzio[3,4], P. Genoni[5], M.Jugovac[3], N. Stojić[6], N. Binggeli[6], S. Bonetti[7], T.O.Menteş[2], A.Locatelli[2]

[1] *Università Ca' Foscari di Venezia, dipartimento di scienze molecolari e nanosistemi, Venezia, Italy*

[3] *Uppsala University, department of physics and astronomy, Uppsala, Sweden*

[2] *Elettra-Sincrotrone Trieste S.C.p.A., Basovizza, Trieste, Italy*

[4] *CERIC-ERIC, Basovizza, Trieste, Italy*

[5] *CIMaINa, Università degli studi di Milano, department of physics and astronomy, Milano, Italy*

[6] *The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy*

[7] *Stockholm University, department of physics, Stockholm, Sweden*

andrea.locatelli@elettra.eu

Interfacial interactions at thin ferromagnetic (FM) films can be exploited to tune the film's magnetic properties through strain, chemical interactions or electronic effects. A classic example is that of spin reorientation transitions [1]. Notably, interfacial interactions have also an essential role in determining the coupling between two FM layers, enabling artificial bilayers with given coupling to be fabricated [2].

The combination of 2D materials with FM layers has great potential in the practical engineering of such interfacial systems. A model system that has recently gained attention is that of graphene on cobalt. Focusing on spin-related phenomena, graphene was shown to induce enhancement of perpendicular magnetic anisotropy in Co [3]; further, when Co is supported on a heavy metal, asymmetric exchange interactions can occur, giving rise to Skyrmions [4].

In this talk, we will present different methods to grow graphene on cobalt, including low and high temperature routes, and a method to lithographically pattern Co with graphene [5,6]. We will illustrate the robustness of spin-polarized hybrid states in epitaxially-aligned and rotated graphene on cobalt, demonstrating similar spin filtering properties [7]. Finally, we address the reasons underneath perpendicular magnetic anisotropy (PMA) enhancement in cobalt capped by distinct carbon species, comparing the magnetic behavior of cobalt with graphene, CO and carbides on top. Our experimental observations, carried out by XPEEM and MOKE, will be substantiated by DFT calculations [8].

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