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Graphene/Ferromagnetic fundamental structures investigated at the atomic level using advanced synchrotron X-ray spectroscopies and STM/AFM scanning microscopy

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Hybrid Graphene/magnetic structures display a variety of physical phenomena and properties such as room-temperature long-spin lifetimes, spin filtering and tunnel magneto-resistance [1-2], which could yield a range of innovative graphene spintronic technologies [3]. In views of developing spintronic devices incorporating FM1/graphene/FM2 systems, assessing the possibility to realize exchange coupled magnetic thin-films across a single graphene layer appears of primary importance. Here we present a XAS and XMCD results investigating the magnetic properties of Co/Gr/Co structures on Ir (111) and Pt (111)/Al2O3 (0001) substrates. We have also pointed out the orbital and spin moments of the intercalated Cobalt layer that were found using sum rules analysis. The hybrid magnetic heterostructures were in-situ fabricated via molecular beam epitaxy (MBE) and using intercalation procedures [4, 5].Our results demonstrate an antiferromagnetic exchange coupling across the Graphene spacing layer in the Co/Gr/Co/Ir (111), in good agreement with a recent theoretical prediction [6] and similarly to our previous results for Co/Gr/Fe/Ir (111) structures [7]. Additionally, early results on the study of the magnetic properties of Co/Gr/Co/Pt/Al2O3 (0001) structures will be discussed. Finally, the presentation will briefly outline the work planned for the next months, which includes: i) the completion of the on-going set-up of two UHV deposition and AFM-STM analysis chambers, ii) the in-situ study by AFM-STM of FM1/Gr/FM2 trilayer structures, iii) the fabrication and investigation of other related hybrid structures on alternative substrates such as Silicon and a stepped single crystal surface.

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