

Tailoring the Structural, Electronic and Magnetic Properties of C₆₀/Fe(001) through Insertion of a Two-Dimensional Oxide at the Interface

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Heterostructures composed by Carbon-based molecules and ferromagnetic materials are the basic building blocks for advanced organic spintronics devices [1]. In these hybrid systems, the injection and manipulation of spin strongly depend on the coupling between the ferromagnetic and the organic layer, therefore a detailed control over the interface is required.

In this talk, we discuss the influence of an ultra-thin oxide on the C₆₀/Fe(001) interface by comparing the properties of C₆₀ deposited on Fe(001), Fe-*p*(1x1)O and Cr₄O₅ monolayer/Fe(001). Scanning tunneling microscopy provides atomic-scale insights on the early stages of growth of C₆₀, revealing that the presence of an oxide monolayer promotes the self-assembly of highly ordered molecular films. Scanning tunneling spectroscopy, UV photoemission spectroscopy and inverse photoemission spectroscopy indicate that the interfacial oxide influences also the hybridization between the molecular orbitals and the electronic states of the substrate [2]. Finally, the magnetic coupling developing at the interface is investigated by X-ray Magnetic Circular Dichroism and modeled by ab-initio simulations. Spin-polarized hybridized states are present for C₆₀ in each substrate, but they are particularly enhanced in the case of the C₆₀/Cr₄O₅ interface [3]. Our results indicate that two-dimensional oxides can be used to finely tune the electronic and magnetic properties of organic spintronics systems.

References:

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