Investigation of nanostructures based on Cr_2O_3 for the application in organic antiferromagnetic spintronics

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Interfaces play a prominent role in spintronics, involving the coupling of both ferromagnetic (FM) and antiferromagnetic (AF) materials. A special case is that of organic semiconductor (OS) interfaced to magnetic layers (*spinterfaces*) [1]. We are currently developing a promising spinterface approach to the rapidly developing fields of Antiferromagnetic (AF) Spintronics and AF Magnonics [2], by realizing oxide-based OS/AF interfaces, aimed to transduce electromagnetic radiation and spin waves. These ideas are under development in the ongoing EU-FET project SINFONIA [3], during which we have been investigating different combinations of AF oxides (e.g., Cr_2O_3, NiO and CoO) and suitable molecular materials (e.g, C_{60}; Pentacene; Metal-Tetra Phenyl Porphyrins - MTPP; Metal Phthalocyanines - MPc [4]).

In this presentation, I will introduce the concepts of our project and a series of results related to the growth and characterization (including crystalline, morphologic, and electronic properties) of Cr_2O_3 on various substrates (see, e.g., Fig. 1). Concerning spinterfaces, we have been focusing on the effect that the adsorption of the molecules has on the magnetic properties of the AF oxide surface and on the effective role played by the interface states for the filtering of spins, which can be potentially exploited in organic spintronics applications. We will present, in particular, promising results concerning the magnetic ordering of Iron phthalocyanine (FePc) as self-assembled monolayers on Cr_2O_3.

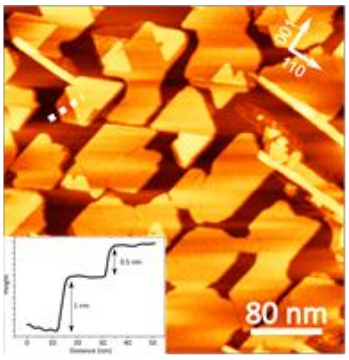

Figure 1: STM image of 0.5 nm Cr_2O_3 on Cu(110). Inset: line profile along the dashed line.

[1] Mirko Cinchetti, V. Alek Dediu and Luis E. Hueso, *Nature Materials* 2017, 16, 507.

[2] V. Baltz, A. Manchon, M. Tsoi, et al., *Rev. Mod. Phys.* 2018, 90, 015005.

[3] SINFONIA FET project, grant n. 964396 - www.sinfonia-fet.eu

[4] J. M. Gottfried, *Surf. Sci. Rep.* 2015, 70, 259.