ESRF	**Experiment title:** Role of magnetic substrate in the behaviour of Fe4-based evaporated ultra-thin films of Single Molecule Magnets	**Experiment number**: HE3257
Beamline: ID08	**Date of experiment**: from: 24 febbraio 2010 to: 09 marzo 2010	**Date of report**: 20 July 2010
Shifts: 39	**Local contact(s)**: Júlio C. CEZAR	*Received at ESRF:*

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Report:

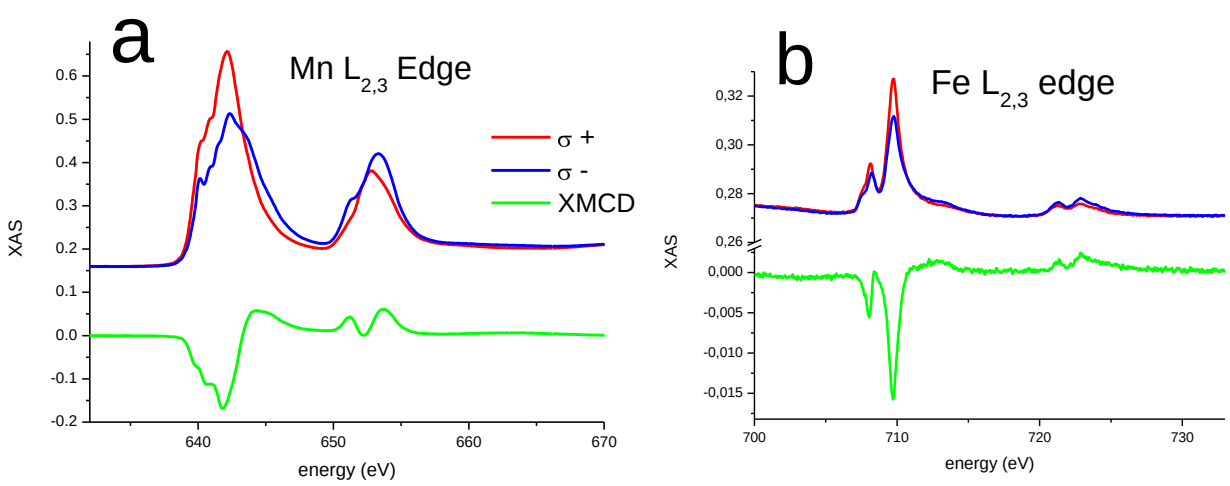
Single Molecule Magnets (SMM)[1] are a class of magnetic molecular materials which hold great promises in molecular spintronics and data storage. For this reason, a number of recent studies have targeted their organization into nanostructured architectures at solid surfaces[2]. Using X-ray Magnetic Circular Dichroism (XMCD), we have demonstrated that a properly-functionalized tetra-iron(III) SMM, Fe_4, can be anchored to surfaces as a monolayer from solution and that the deposit so-obtained maintains the SMM features typical of the bulk phase[3]. We have also demonstrated that a differently functionalized Fe_4 SMM can be transferred to surfaces as a thick film by thermal evaporation in high vacuum, with full retention of magnetic properties as evidenced by standard magnetometry and EPR studies[4].

During our previous beamtime (HE-2984) by using the XMCD technique we provided the unambiguous evidence that the electronic and magnetic structure of Fe_4 is preserved upon evaporation on top of a non-magnetic substrate, the Au(111) surface, down to the monolayer level. Moreover X-ray Natural Linear Dichroism (XNLD) suggested that on top of this surface the Fe_4 molecules assemble in a partially ordered fashion. The aim of this "second step" proposal (HE-3257) was to carefully investigate by XMCD and XNLD the influence of a stable ferromagnetic substrate on the electronic and magnetic properties of evaporated SMM.

The first part of the experiment (waiting for the beamtime) has been devoted to setting up the equipment required for *in-situ* sample preparation. The same effusion cell used during previous beamtime has been installed on the STM-preparation chamber directly connected to the experimental chamber. Au(111) and Cu(100) single crystals have been prepared by cyclic treatments and used as substrates for reference depositions.

Ex-situ prepared substrates constituted by a thin film of, a ferromagnetic oxide with formula $La_{1-x}Sr_xMnO_3$ and a perovskite-like structure, abbreviated in LSMO, have been selected for their chemical stability. STM, LEED and reverse-LEED facilities have been used to verify the quality of these substrate before the

deposition. At the beginning of the official beamtime we started a series of measurements on Fe4 layer samples with different nominal thickness in order to calibrate the deposition of monolayers. Then we measured also the LSMO substrate by recording XMCD (see figure 1a), XNLD and hysteresis curves. Such measurements confirmed the expected mixed-valence electronic structure of Mn-centers as well as the magnetic anisotropy of the film. Finally we evaporated a monolayer deposit of Fe_4 on top of LSMO.
XAS/XMCD characterization confirmed the presence of electronically intact Fe_4 complexes (see figure 1b), though XNLD analysis failed to reveal a preferential molecular orientation on the suface. Detailed data analysis is currently in progress to explain the observed XMCD dependence upon applied magnetic field.
The results obtained in this beamtime, coupled with the previous one and with additional measurements will be soon inserted in a publication in an international journal.



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