

In the beamtime HE2211 on the beamline ID8 we exploited X-ray Absorption Spectroscopy (XAS) and X-ray Magnetic Circular Dichroism (XMCD) to investigate the electronic and magnetic properties of thick films of molecular $\{\text{Cr}_8\}$ and $\{\text{Cr}_7\text{Ni}\}$ antiferromagnetic rings and of monolayers of $\{\text{Cr}_7\text{Ni}\}$ grafted on Au(111).

The data for the thick films have already been elaborated and published on PRB [1]. In this case we determined the local symmetries, the electronic configuration and the values of orbital and spin moments at the Cr and Ni sites of the molecular rings. XMCD measurements show that the exchange coupling between the Cr and Ni spins in the $\{\text{Cr}_7\text{Ni}\}$ molecular ring switches from antiferromagnetic to ferromagnetic with increasing temperature. These data are interpreted using XMCD sum rules, that allow to separately evaluate the spin and the orbital contributions to the total magnetic moment of the ring as a function of temperature and magnetic field. The Cr_8 ring was studied as a benchmark, in order to fix the best parameters for the application of the sum rules to the Cr^{3+} ions.

The magnetic behaviours experimentally observed have been compared with the results of spin Hamiltonian calculations, based on microscopic parameters derived by inelastic-neutron scattering and low-temperature specific heat measurements. The very good agreement between experimental data and calculations is a clear indication of the integrity of molecules. The temperature dependence of the ion magnetic moments results from the interplay between Zeeman and isotropic-exchange contributions and is well captured by the theoretical model. For the Monolayers the data have been treated in the same way as for the thick films but are still in elaboration and will be presented in the next future. The surprising novelty is that the Ni spin seems to couple ferromagnetically to neighbouring Cr even at the lowest temperature. Calculations to account for this behaviour are actually ongoing.

[1] V. Corradini, F. Moro, R. Biagi, U. del Pennino, V. De Renzi, S. Carretta, P. Santini, M. Affronte, J.C. Cezar, G.A. Timco and R.E.P. Winpenny, "XMCD investigation of spin and orbital moments in Cr_8 and Cr_7Ni antiferromagnetic rings", Phys.Rev.B 77, 014402 (2008)