

HE-1001 experimental report

The purpose of this project is to study the magnetisation reversal dynamics in Co/NiO and Co/NiO/FeNi thin layers by time-resolved XMCD measurements.

FM/AF layers are largely studied for applications to spin-valve magnetoresistance read-heads, where the anisotropy of the interface exchange interaction is at the origin of the pinning of the FM layer magnetisation.

Our samples are grown by magnetron scattering at DRFMC. The Co magnetisation presents an in-plane uniaxial anisotropy induced by the deposition geometry. At room temperature the samples do not show any exchange bias, which indicates that the NiO magnetisation irreversibly turns when the magnetisation of the Co layer turns at the coercive field. The reversal of the magnetisation of the whole NiO layer is triggered by the reversal of the uncompensated Ni moments at the AF/FM interface. It is therefore important to study the dynamics of the NiO layer magnetisation and to compare it to that of the Co layer. This is achievable by the time-resolved XMCD measurements which we have developed on ID12B. The dynamic measurements in single bunch mode will be carried out in December 2001 on ID8.

In July 2001 quasi-static XMCD measurements have been carried out on ID8 on a Co(30Å)/NiO(250Å) bilayer to probe the net magnetic moment of Ni at the AF/FM interface. This measurement was an essential test to be carried out before the time-resolved measurements. Previous attempts to measure the net magnetisation of Ni in similar sputtered Co/NiO bilayers had failed on ID12A. On ID8 we could measure without difficulty a metallic-like XMCD signal at the Ni $L_{2,3}$ edge. The amplitude of the XMCD is less than 3% of the total absorption.

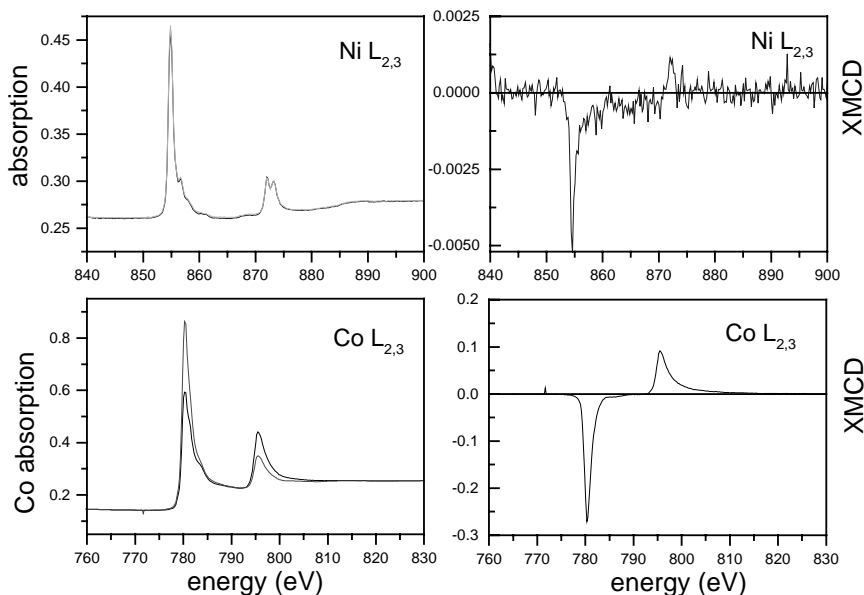


Figure 1: *Left:* total absorption with left and right circular polarisation of the Co/NiO bilayer at the Ni (top) and Co $L_{2,3}$ (bottom) edge; *Right:* the corresponding XMCD spectra.

The quasi-static hysteresis loops measured for the Co and NiO layer are shown in Figure 2.

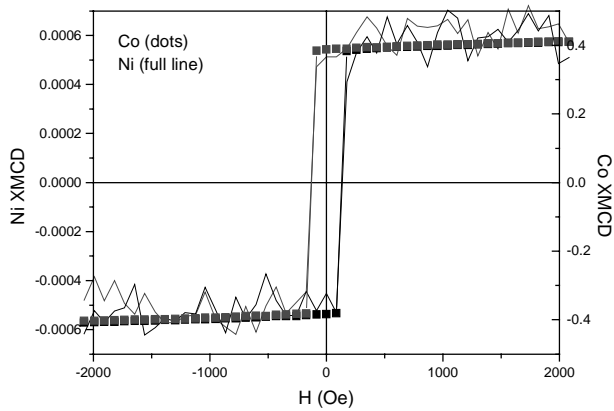


Figure 2: quasi-static hysteresis curves measured for the NiO and the Co layers by XMCD.

The two layers appear to switch in the same field. Dynamical measurements will compare the dynamics of the magnetisation reversal of the two layers.

Note that in the single bunch time allocated in July 2001, we have installed and tested the time-resolved XMCD set-up which was transferred from ID12B to ID8.

The second step of the dynamic measurements in December 2002 will be to measure the magnetisation dynamics of a Co/NiO/FeNi trilayer where a 90° alignment between the magnetisation of the two FM layers has been measured by Kerr and XMCD measurements.