ESRF	Element-selective magnetisation dynamics investigated by time-resolved XMCD	**Experiment number**: HE-863
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The time-resolved XMCD measurements which we developed on beamline ID12B take advantage of the ESRF time structure in single bunch mode. The measurements are carried out in pump-probe mode, where the magnetic field pulses generated by a copper microcoil (the pump) are synchronized with the ESRF photon bunches (the probe). The time-dependence of the magnetisation of the probed sample during and after the field pulse is studied by changing the delay between the pump and the probe, and by measuring, for each delay, the corresponding L_3-edge XMCD signal. The magnetisation dynamics of Co and permalloy layers in spin valve and tunnel junction systems have been studied. The importance of the magnetic coupling between the two ferromagnetic layers across the non magnetic spacer and its influence on their magnetisation dynamics has been addressed (see experimental report HE-641).

The first part of the August run on ID12B was used for some experimental developments. A new sample holder was installed, where the microcoil was tilted at 30° with respect to the incident x-ray beam. The sample could then be mounted flat on the microcoil and this made easier and more reproducible the alignment of the beam on the sample (and therefore the value of the field pulse applied on the sample). We also tested the effect of the sample size on the magnetisation dynamics measurements – the magnetic field decreases rapidly away from the plane of the coil and therefore the field is not homogeneous away from the

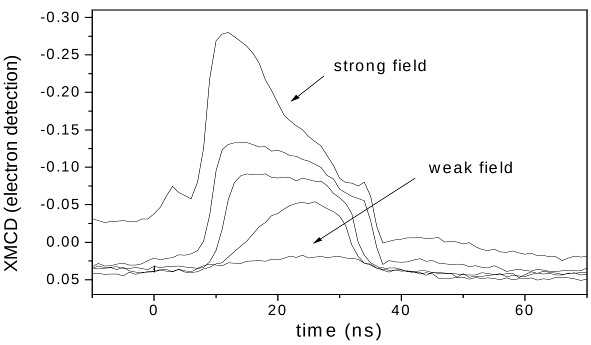

Figure 1

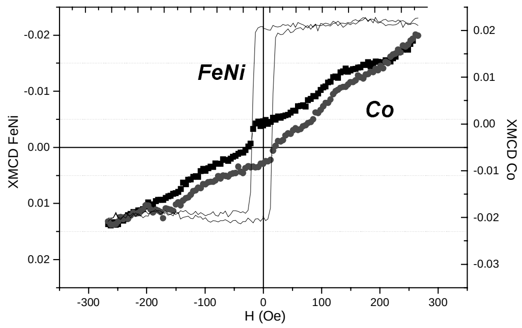

Figure 2

center of the coil. We found that, as long as the sample is properly aligned with respect to the beam, the inhomogeneity of the field on the sample surface does not affect the measurements.

Some tests were also done to check the feasibility of electron yield detection in the presence of the pulsed magnetic field. Our aim had been to measure the time dependence of the magnetisation reversal of Ni in a Co/NiO bilayer, where a hard layer of Co is pinned by the antiferromagnet NiO. We expected the magnetisation reversal of Ni to be different from that of Co. Note that, NiO being an AF, the measurable XMCD signal only comes from the uncompensated moment at the interface with Co, and is therefore expected to be small. A small XMCD signal was previously measured by Mocuta *et al*. in single crystal Co/NiO(111) in electron detection.

We found that for weak magnetic field pulses the time-dependent signal could be measured in electron yield without important distortions (Figure 1). For larger magnetic field pulses a large asymmetry between the spectra taken with different helicities was measured. This made the measurements impossible, as quite large magnetic fields are required to turn the Co (and therefore Ni) magnetisation in dynamical conditions.

As a possible solution to this experimental problem we have started to investigate samples in which a thin layer of ferromagnetic material deposited on top of the NiO, and to which NiO is coupled, is used as a probe of the uncompensated Ni moment. The most adapted sample for this experiment has the composition glass/FeNi(100Å)/NiO/Co(20Å). In this sample FeNi couples well to NiO, and the coercitivity of Co is larger than that of the FeNi layer. The selective hysteresis loops measured for the permalloy and the Co layer by XMCD have shown an unexpected behaviour. While the cycle measured for FeNi is typical of easy axis magnetisation, that measured for Co is typical of hard axis magnetisation. It appears that in this sample the magnetisations of the two layers form a 90° angle (biquadratic coupling). Numeric simulations are being carried out to understand this coupling. Time-dependent measurements for the Co and FeNi layer appear to be promising for a better understanding of this system.