XMaS the UK-CRG	**Experiment title:** Evolution of stacking faults with layer thickness in Co-alloy thin films	**Experiment number:** 28-01-106
Beamline: **BM 28**	**Date of experiment:** from: 25/4/01 to: 29/4/01	**Date of report:** 29th October 2001
Shifts: 9	**Local contact(s):** Dr. D. Mannix	*Received at XMaS:*

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Report:

In our previous XMaS experiments we have measured stacking fault densities to within 1% in Co-alloy thin films of about 300Å [e.g. 1,2]. In this experiment we examined thinner films. Due the short period of beamtime, only two films were examined in detail, incorporating a Cr alloy underlayer and a CoCr 'intermediate' layer immediately prior to the first magnetic layer. The intermediate layer improves the epitaxial matching of the magnetic alloy layer with its underlayers thus minimising stacking faults. The CoCrPtB magnetic layer was 30Å for sample C2 and 130Å for sample C9.

Specular reflectivity scans were used to determine the appropriate incident grazing angle, α, that would restrict the X-ray penetration depth to the top magnetic layer in each film. In practise it is difficult to restrict the penetration depth accurately unless the incident resolution is very high, not possible here due to the weak in-plane scattering in these films. Suitable values of α were determined from the reflectivity scans corresponding to angles just

either side of the critical angle at around 0.27°. Fig. 1 shows in-plane diffraction scans in the region of the (100), (002) and (101) peaks for the 130Å film. When α is below the critical angle, the hcp Co-alloy (002) peak is at the expected position for the magnetic layer whereas when α is above the critical angle (e.g. α=0.4°) the position of the (002) peak shifts from 2θ=34.8° to 35.5° and broadens considerably as the convoluted peaks of the both the magnetic and intermediate layers are detected. A full analysis of the stacking faults gave a value of 5% which is much less than in previous films, suggesting that the intermediate layer does improve the epitaxy of the magnetic layer to its underlayers.

Similar scans were performed for the 30Å film (C2). However as can be seen in Fig. 3, the penetration depth could not be restricted to only the magnetic layer and thus the hcp Co(002) peak was at 2θ=35.5° for all values of α. It was thus not possible to obtain a scan from which the stacking fault density could be estimated. Overall it is not possible to assess the layer thickness dependence of stacking faults from this short experiment. These results are part of a larger study and have been included in a recent paper [3].

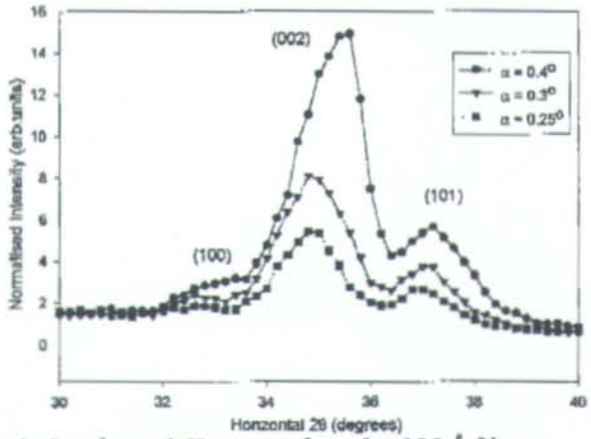

Fig 1. *In-plane diffraction data for 130Å film.*

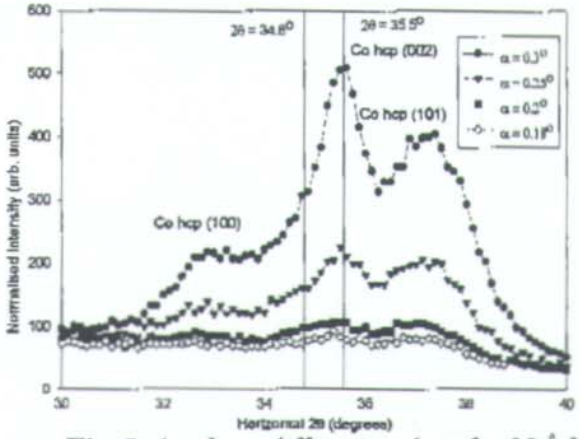

Fig. 2. *In-plane diffraction data for 30Å film.*

[1] L. Holloway and H. Laidler, J.Appl.Phys. 87, 5690 (2000).

[2] L. Holloway, H. Laidler, N.D. Telling, S.Z. Wu, J.Appl.Phys. 90, 7 (2001) pp. 4056 - 4062.

[3] C. Zambon, L. Holloway, W.J. Antel Jr., H. Laidler, E. Girt, S.D. Harkness (submitted to J.Appl.Phys.)