ESRF	**Experiment title:** Magnetic x ray diffraction in cobalt deposits on Pt(111) surfaces	**Experiment number:** SI 220
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Report:

We have performed resonant surface magnetic diffraction measurements from thin cobalt films deposited on Pt(111). The measurement technique was the same than in the work of the bulk Co3Pt alloy [l] namely the measurement of the asymmetry ratio along crystal truncation rods. This technique allows to extract the magnetic part of the structure factor which can be shown to be proportional to the induced magnetic moment of the Pt atoms. As stated in the proposal we made experiments to investigate the possibility of differentiating perpendicular vs parallel magnetic anisotropy. Unfortunately we could not achieve a control of the magnetic field intensity precise enough to get conclusive results. In the near future it is planed to substitute the permanent magnet that usually is employed by magnetic coils that should allow a better control of the field intensity.

In spite of this, several physically interesting experiments were performed in the same epitaxial system.

Figure 1 shows the asymmetry ratio of a Pt reflection measured in a in a fixed position in reciprocal space close to a crystal truncation rod minimum as a function of the thickness of the cobalt films deposited at room temperature. The asymmetry ratio at resonance increases rather linearly when the thickness of the cobalt film increases. The figure also shows, schematically, the results of magneto-optical Kerr effect measurements by McGee et al [2] on a Co wedge grown on Pt (111). The continuous and dashed lines correspond respectively to their results on the Kerr rotation and Kerr ellipticity. Both signals are proportional to

the average magnetization of the cobalt film. The similarity in the trends of the asymmetry ratio and Kerr signals when the thickness of the film increases, indicates that the magnetic moment of the Pt atoms at the Co/Pt interface (which is roughly proportional to the value of R as it has been mentioned above) is proportional to the average magnetization of the cobalt As a consequence, it appears that the value of R at resonance may be used in practice as a probe of the magnetization of the ferromagnetic film.

Another relevant questions that one may ask are: how many layers of the Pt crystal are magnetized by the ferromagnetic overlayer? How the induced magnetization of the Pt decreases when one goes to the bulk of the crystal, away from the interface?
To answer this question we measured the asymmetry ratio along a crystal truncation rod of the Pt substrate. In normal surface crystallography measurments of the intensities along CTR allow to detemine coordinates along the surface normal direction. Similarly the magnetic measurements allow to determine the distribution along the surface normal of magnetised Pt atoms and the values of their magnetization.
Figure 2 shows the measuments for a 8 layers thick cobalt film. Without entering in details, the solid curve which is a fit to the data domonstrates that only one atomic plane of Pt is magnetised, the one that is in contact with the ferromagnetic overlayer; the magnetisation of the second atomic plane of the Pt is almost ten times smaller.
These results will be submitted for publication very soon.
Refs.
[I] S. Ferrer, P. Fajardo, F. de Bergevin, J. Alvarez, X. Torrelles, H.A. van der Vegt and V.H. Etgens, Phys. Rev. Lett. 77,747 (1996)
[2] N. W. E. McGee, M. T. Jhonson, J.J. de Vries and J. aan de Stegge, J. Appl. Phys. 73 ,3418 (1973)

Figure 1

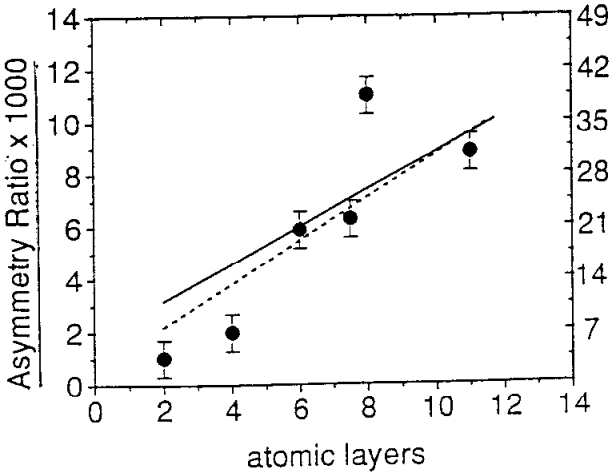

Figure 2: magnetic rod (1,0,L)