ESRF	**Correlation between magneto-crystalline anisotropy and growth-induced chemical anisotropy in expitaxial $CoPt_3$ thin film alloy.**	**Experiment number:** HE-220
Beamline: ID12 B	**Date of experiment:** from: 3/09/97 to: 7/09/97	**Date of report:** 14/10/97
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Compared to classical bulk methods, alloying thanks to the ultra-high vacuum evaporation methods such as molecular beam epitaxy (MBE) benefits of surface diffusion controlled by an appropriate choice of temperature growth and deposition rates It is an appealing route to "fabricate" materials with specific properties It is of prime importance as far as magnetic and magneto-optic recording are the targets of the process In this respect, Co_xPt_{1-x} thin films alloys, that are characterized by large Kerr rotations as short wave lengths and strong magneto-crystalline anisotropy (MCA), appear as good candidates to substitute the current TbFeCo media. Recently, strong perpendicular magnetic anisotropy (as large as $10^7 erg.cm^{-3}$) as well as 100% perpendicular remanence has been observed in (Ill)-oriented fcc $CoPt_3$ alloy films This was unexpected for a cubic lattice and was attributed to the existence of an anisotropic local chemical order. MCA is known to be a microscopic effect, but most evidences of MCA comes from macroscopic measurements (either torque or magnetization) To demonstrate unambiguously the correlation between MCA and this growth-induced chemical anisotropy, we performed angle-dependent X-ray magnetic circular dichroism measurements at both the Co $L_{2,3}$ edges. Figure 1 shows a typical XMCD spectra recorded in the total electron yield detection mode at γ=60° The XMCD signal is normalized to the isotropic absorption cross section (i e approximately, the half-sum of the absorption cross section recorded for left- and right-handed circularly polarized light) corresponding to the $2p \rightarrow 3d$ transitions and is corrected for the finite rate of circular polarization. Using the notation of Arvanitis et al. the angle-dependent orbital sum rule for XMCD takes the following form: $m^{\gamma}_{orb} = -(2Q^{\gamma}/3)(10 - n_{3d})$ (1)

where m^{γ}_{orb} is the orbital moment measured at the angle y, n_{3d} is the number of electrons in the 3d shell and Q^{γ} is the normalized integrated dichroism intensity at the angle γ. The value of the magnetic field was strong enough to saturate the magnetic moment, so that no additional data corrections are needed. According to (1) the integral Q^{γ} of each XMCD signal (shown in the inset of figure 1) is directly proportional to the orbital moment. The drastic diminution of the orbitmoment when the spins are forced out of the [111]

applied magnetic field is the signature of the strong MCA. In the case of an uniaxial anisotropy, it has been found that the *3d* orbital moment varies (at lowest order) as $m_{orb}^{\perp} - (m_{orb}^{//} - m_{orb}^{\perp}) sin^2\gamma$, where $m_{orb}^{\perp}$ and $m_{orb}^{//}$ denote respectively the orbital moment measured along and perpendicular to the easy axis of magnetization (i.e. the normal of the surface) Figure 2 shows the excellent agreement between our experiments and this theoretical prediction (full curve) supporting the present model. Taking 7.75 for the *3d* electron occupation number, we found $m_{orb}^{\perp} - m_{orb}^{//} = 0.14\mu_B$ and $m_{orb}^{\perp} = (0.3\,1 \pm 0.02)\mu_B$. This enhancement of the orbital moment (the value measured for bulk hcp Co [000l] is $m_{orb}^{\perp} = 0.15\mu_B$) is consistent with previous XMCD experiments that have found an obvious connection between orbital moment, MCA and the breaking of symmetry at interfaces.

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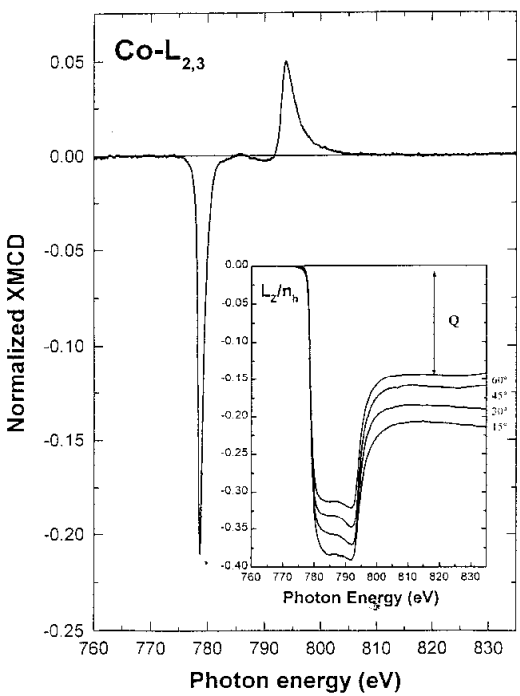

Figure 1

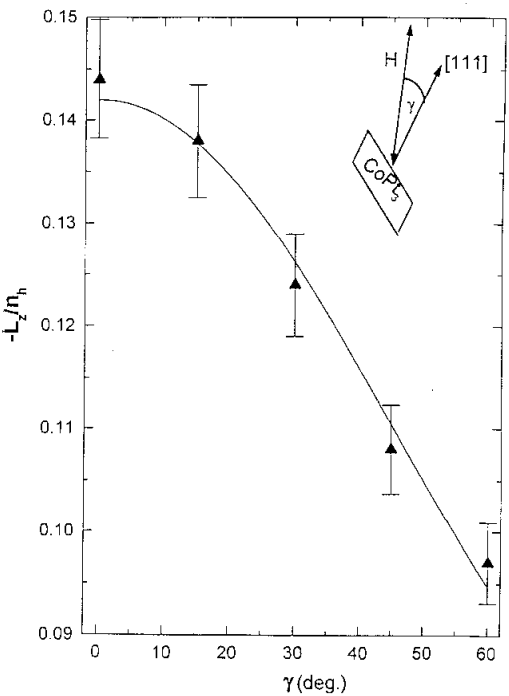

Figure 2