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Shifts: 18	Local contact(s): Dr. Sarnjeet DHESI (e-mail: dhesi@esrf.fr)	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Karine CHESNEL* CEA Grenoble DRFMC/ SP2M / IRS 17, av des Martyrs 38054 Grenoble

Michel BELAKHOVSKY* CEA Grenoble DRFMC/ SP2M / IRS 17, av des Martyrs 38054 Grenoble

Stefan LANDIS CEA Grenoble DRFMC/ SP2M / IRS 17, av des Martyrs 38054 Grenoble

Bernard RODMACQ CEA Grenoble DRFMC/ SP2M / IRS 17, av des Martyrs 38054 Grenoble

Bernard DIENY CEA Grenoble DRFMC/ SP2M / IRS 17, av des Martyrs 38054 Grenoble
Esther DUDZIK* HMI, Berlin, Germany
Sarnjeet DHESI* ESRF, ID8
Steve P. COLLINS* SRS, Daresbury , UK.
Gerrit van der LAAN SRS, Daresbury , UK.

Report:

Only a preliminary and partial report will be presented here, since the experiment was performed very recently. It deals with Co/Pt patterned media and on FePd thin films, using the 2-circle vacuum Daresbury diffractometer as before for the XRMS measurement on Co and Fe L-edges.

1) Co/Pt patterned system : H-field dependence of the ferromagnetic contribution

In the Co/Pt patterned media, we had previously studied in detail the pure magnetic antiferromagnetic satellites that are present in between the mainly structural peaks arising from the periodic patterning [HE-864]. By contrast here, the first part of the experiment was centred on the magnetic contribution on top of the structural peaks. Applying a perpendicular magnetic field in situ with an electromagnet inside the diffraction chamber enables to monitor of the evolution of the XRMS spectrum with field strength.

The first plots in Fig. 1 show the variation of the intensities for the specular peak (a) as well as superlattice peaks: left (b) and right (b') first order, and left (c) and right (c') second order. The intensity variations detected in the specular peak (a) is directly proportional to the total magnetization and reproduces the hysteresis loop, also observable on all the superlattice peaks. The intensity of these peaks contains information about magnetic correlations between the lines at the grating periodicity, i.e. ferromagnetic order, sensitive to the hysteresis phenomena.

One can observe a specific reversal effect between the left and right satellites This dichroic effect can be quantified by an asymmetry ratio $R = (I_+ - I_-)/(I_+ + I_-)$. The evolution of the measured R ratio with the harmonic position is represented in Fig. 2. The modeling of this result is underway.

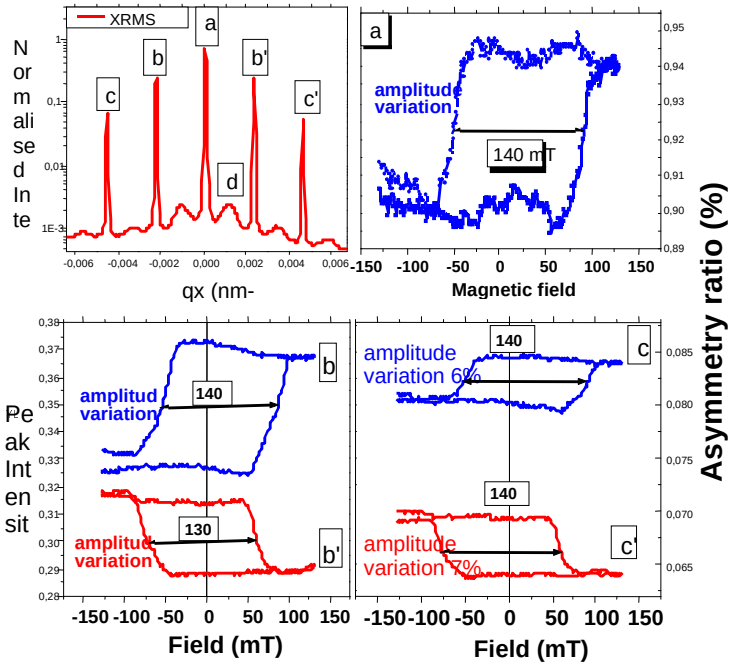


Fig. 1 Evolution of the "structural" peaks (a, b, b', c, c') while the H-field sweeps the hysteresis loop

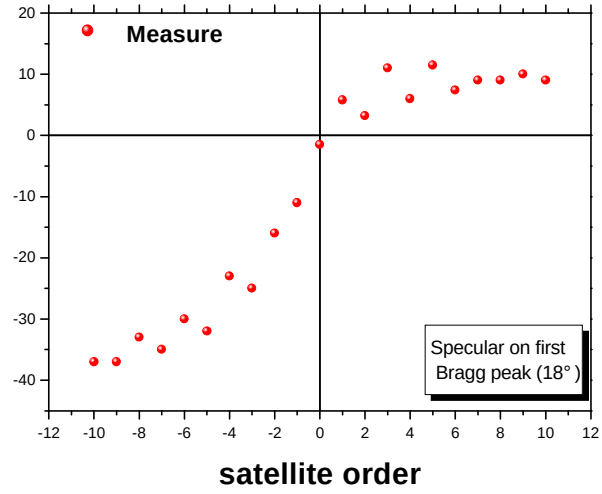


Fig. 2 Variation of the asymmetry ratio with the the order of the "structural" satellite

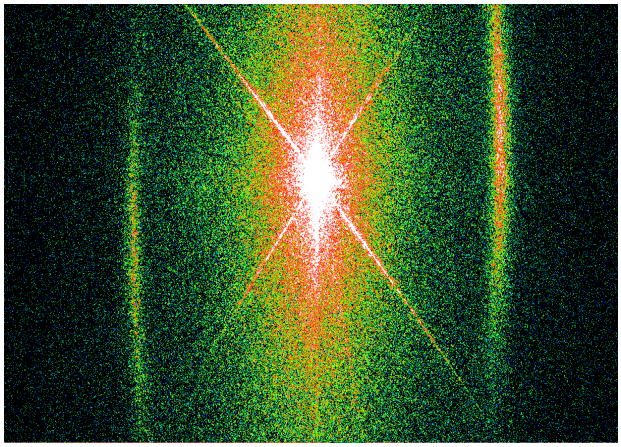
2. Reciprocal space 2D-imaging and Magnetic Speckle Pattern in Reflection Geometry

The second and major result of the experiment results from the implementation :

- of a 2D-CCD camera, whose active area is directly inside the vacuum vessel
- of a 20 µm pinhole also inside the diffractometer in place of entrance slits.

Fig. 3 shows difference in intensities between right and left magnetic AF satellites (that switch with helicity, as in [2].

The main result is their granularities, characteristic of a magnetic speckle pattern [3], here obtained in the reflection geommetry. Analysis of such pictures with different H-fields is underway.



CCD camera 16 bits

Fig.3 Pure magnetic satellites around the specular, one enlarged to show its speckle pattern behaviour

References

[1] K. Chesnel et al, Study of the magnetic coupling in Co/Pt nanolines and its evolution under magnetic field (submitted to Phys. Rev. B)

[2] H. Dürr et al, Science 284 (1999) 2166

[3] To be published