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ESRF

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office using the **Electronic Report Submission Application:**

http://193.49.43.2:8080/smis/servlet/UserUtils?start

Reports supporting requests for additional beam time

Reports can now be submitted independently of new proposals – it is necessary simply to indicate the number of the report(s) supporting a new proposal on the proposal form.

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Deadlines for submission of Experimental Reports

- 1st March for experiments carried out up until June of the previous year;
- 1st September for experiments carried out up until January of the same year.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report, in English.
- include the reference number of the proposal to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.

ESRF	Experiment title: ***Au magnetic moment in AuFe alloys probed by x-ray magnetic circular dichroism***	**Experiment number**: HE-2126
Beamline: ID12	**Date of experiment**: from: 05/07/06 to: 10/07/06	**Date of report**: 02/03/07
Shifts: 18	**Local contact(s)**: F. Wilhelm	*Received at ESRF:*

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Report:

In this experiment, the Au magnetic moments in AuFe alloys in both the *fcc* and the *bcc* phase were investigated by means of the x-ray magnetic circular dichroism (XMCD) technique. The samples were fabricated in bulk form by the arc melting technique under 600 mbar Ar atmosphere. X-ray diffraction (XRD) measurements have revealed that samples with high Fe concentration are *bcc*, while as the Au concentration increases, the *fcc* structure is stabilized. Our SQUID magnetometry experiments have revealed that the *bcc* samples have a total

magnetization which is consistent to the magnetization of bulk Fe (about 1700 emu/cm^3). On the other hand, the magnetic moment per unit cell in the fcc samples is very large (it corresponds to about 3 μ_B/Fe-atom – high spin state).

XMCD experiments were done on three samples, namely bcc Au_3Fe_{97}, fcc $Au_{50}Fe_{50}$ and fcc $Au_{75}Fe_{25}$ alloys at the Au L-edges. A reference pure Au metal foil was also measured. Below we present preliminary results for our measurements. In Figure 1 we show the XRD spectrum from the $Au_{50}Fe_{50}$ alloy indicating the stabilization of a single phase. In Figure 2, we show the x-ray absorption (XAS) and the XMCD spectra from the same alloy. From the XMCD spectra one may clearly see an induced Au moment aligned perallel to the Fe moment. Finally, Figure 3 shows an increase of the Au moment with the Fe-content of the alloys. At the moment, ab initio calculations are taken place from A.N. Yaresko in order a complete theoretical and experimental understanding to be developed [1].

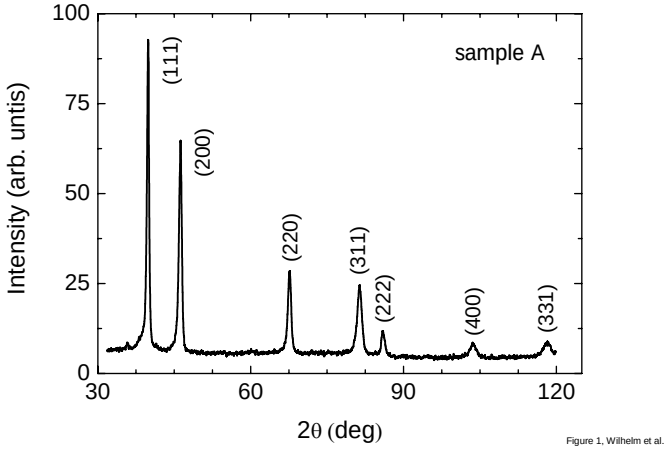

Figure 1: XRD from $Au_{50}Fe_{50}$ alloy (sample A). XRD peaks are labeled. The spectrum provides a clear evidence for a fcc single-phase solid solution.

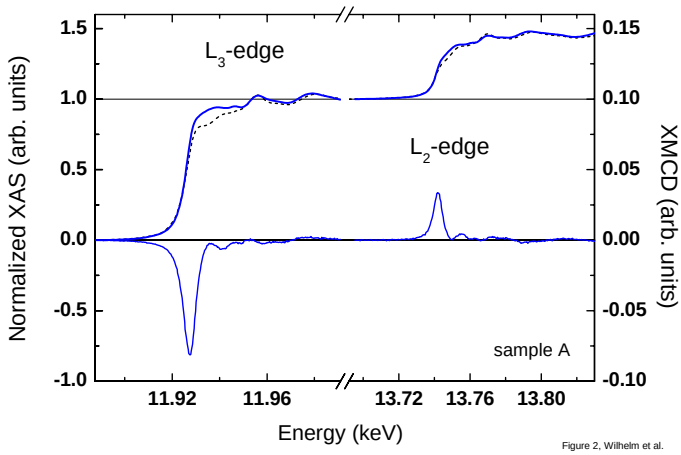

Figure 2: XAS (top, solid line) and XMCD (bottom) spectra recorded at the L-edges of Au in sample A. The corresponding XAS spectra of reference fcc Au are also shown (dashed line).

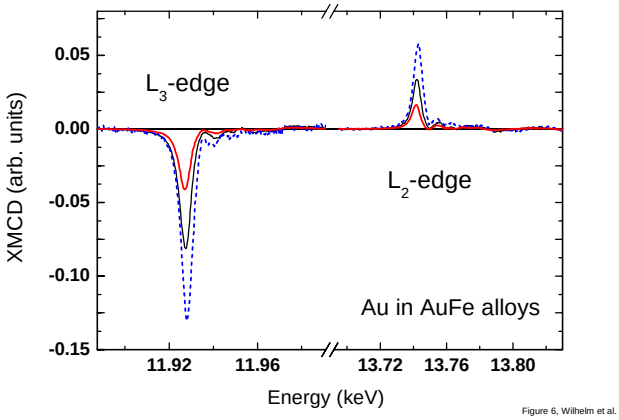

Figure 3: XMCD spectra at the $L_{3,2}$ edges of Au in bcc Au_3Fe_{97} alloy (dashed), fcc $Au_{50}Fe_{50}$ alloy (thin solid) and fcc $Au_{75}Fe_{25}$ alloy (thick solid line).

References

1. F. Wilhelm et al., Phys. Rev. B (to be submitted).