EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

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: ***Element-specific magnetism of the weak ferromagnet VAu_4 and the violation of third Hund's rule***	**Experiment number**: HE-2717
Beamline: ID12	**Date of experiment**: from: 09/07/08 to: 15/07/08	**Date of report**: 30/09/08
Shifts: 18	**Local contact(s)**: F. Wilhelm	*Received at ESRF:*

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Report:

In this experiment, the Au magnetic moments in VAu_4 were investigated by means of the x-ray magnetic circular dichroism (XMCD) technique at the Au $L_{3,2}$ edges. Moreover, XMCD measurements have been performed for the same material at the V K-edge and compared with ones recorded on a prototype Fe/V superlattice. VAu_4 is a very interesting material in the sense that two non-ferromagnetic elements, i.e. V and Au, are combined and form a ferromagnet with a Curie point of 60 K. The material has attracted recently considerable theoretical [1-3] as well as

experimental interest [4]. A violation of the third Hund's rule via the role of ligand states has been predicted [1,2] but not verified yet. Such a violation, however, has been found recently in Fe/W multilayers [5].

In Figure 1 we show the XANES and XMCD recorded at the Au $L_{3,2}$ edges of VAu_4. The shape of XMCD is much different as compared to the ones recorded recently on AuFe alloys (see inset and references [6,7]). Application of the sum rule analysis for Au, done in a similar way described in Ref. [7], gives a negative value for the ratio m_L/m_S of the *d* orbital m_L and spin m_S magnetic moments of Au in VAu_4. This is a direct violation of the third Hund's rule for Au as Au has an almost filled *d*-band. Figure 2 shows the XANES and XMCD recorded at the V K-edge for a reference Fe/V superlattice and in VAu_4. The ferromagnetic signal in Fe/V is due to the induced magnetic moment of V, where the ratio m_L/m_S has been found to be negative as expected from the third Hund's rule for an element like V with less-than-half-filled *d* band, studied in detailed in Ref. [8]. The very different shape of the XMCD and the reverse of the sign of the 2nd XMCD peak may indicate a positive value of m_L/m_S for V, verifying theoretical predictions [1,2]. Analysis is in progress. The results will be the task of a forthcoming paper [9].

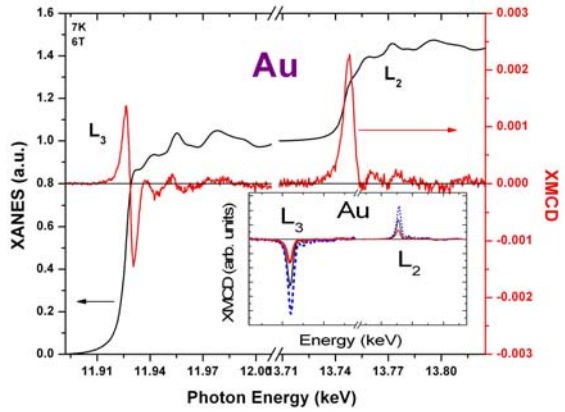

Figure 1: XANES and XMCD at Au $L_{3,2}$ edges of VAu_4. The shape of the XMCD is very different as compared to the ones recorded on AuFe alloys (inset [6,7]).

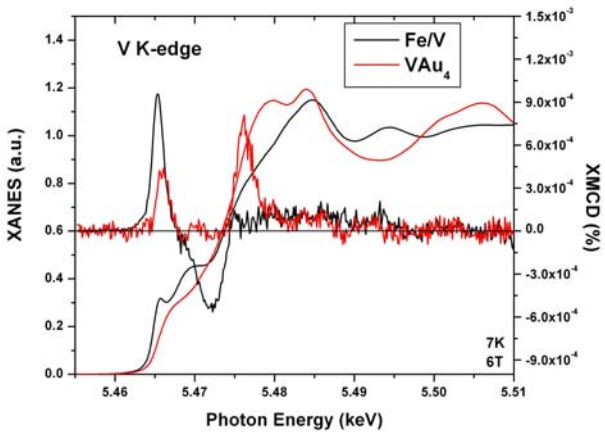

Figure 2: XANES and XMCD recorded at the V K-edge for VAu_4 and a reference Fe/V superlattice. Note the different XMCD spectra.

References

1. I. Galanakis et al., Phys. Rev. B63, 172405 (2000).
2. I. Galanakis et al.. J. Phys.: Cond. Matter 13, 4553 (2001).
3. T. Khmelevska et al., Phys. Rev. B76, 054445 (2007).
4. P.J. Brown et al., J. Phys.: Cond. Matter 18, 2925 (2006).
5. F. Wilhelm et al., Phys. Rev. Lett. 87, 207202 (2001).
6. Experimental Report of the Experiment HE-2126.
7. F. Wilhelm et al., Phys. Rev. B77, 224414 (2008).
8. A. Scherz et al., Phys. Rev. B64, 180407(R) (2001).
9. F. Wilhelm et al., Phys. Rev. B (to be submitted).