

**Experiment title:**

Induced magnetic moments of W and Ir in magnetic multilayers of Fe/W and Fe/Ir probed by XMCD

**Experiment****number:**

HE-636

**Beamline:**

ID 12 A

**Date of experiment:**

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**Shifts:**

21

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*ESRF***Report:**

We report on the induced magnetic moments at the W and Ir layers in magnetic multilayers. Magnetic polarization of W and Ir as impurities in a ferromagnetic environment was previously detected [1]. However, this is the first, to our knowledge, determination of induced magnetic moments of W and Ir at the interface with a 3d ferromagnetic element. Fe/W and Fe/Ir multilayers with ultrathin polarizable layers (about 2 monolayers) were measured at the  $L_{2,3}$  edges of W and Ir at temperatures 10-200 K and magnetic fields up to 5 T. The experiments were performed at the ID12A beamline of the ESRF. The samples were prepared by e-beam evaporation on Kapton and glass substrates and characterized structurally via x-ray diffraction and electron microscopy. Non-element specific magnetic characterization was done by Vibrating Sample Magnetometry. However, it is only the element-specific XMCD technique that it can unambiguously probe the magnetic contribution from the polarizable element. In Fig. 1 we see the x-ray absorption (XAS) and the x-ray magnetic circular dichroic (XMCD) spectra at the  $L_{2,3}$  edges of W. Similar spectra are shown for Ir in Fig. 2. From these spectra the magnetic moments for W and Ir may be

found by applying the sum rules. For the number of d-holes we used the results of fully relativistic *ab initio* calculations [2]. Our basic conclusions are:

- 1) W acquires a magnetic moment of about  $-0.2 \pm 0.1 \mu_B/\text{atom}$  coupled antiparallel to the Fe moment.
- 2) Ir acquires a magnetic moment of  $0.2 \pm 0.1 \mu_B/\text{atom}$  coupled parallel to the Fe moment.
- 3) The sign and values of the magnetic moments are in fair agreement with *ab initio* calculations for W and Ir impurities in ferromagnetic alloys [3].

Details of the present work will be given in a forthcoming publication.

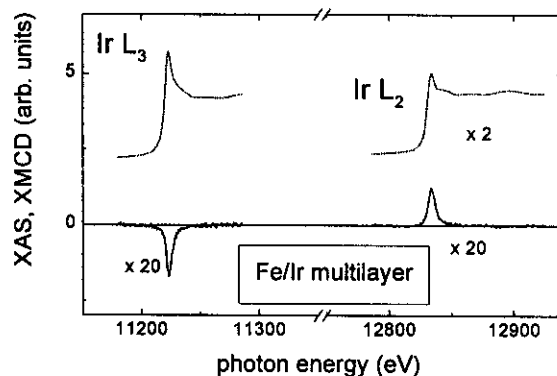
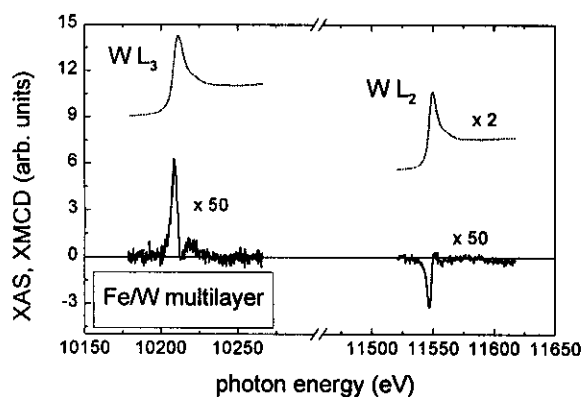


Fig. 1 X-ray absorption and dichroic spectra at the L-edges of W of an Fe/W multilayer

Fig. 2 X-ray absorption and dichroic spectra at the L-edges of Ir of an Fe/Ir multilayer

## References

1. R. Wienke, G. Schütz and H. Hebert, *J. Appl. Phys.* **69**, 6147 (1991)
2. V. Popescu and H. Ebert (unpublished).
3. H. Hebert, R. Zeller, B. Drittler and P. H. Dederichs, *J. Appl. Phys.* **67**, 4576 (1990)
4. F. Wilhelm et al. (to be submitted)