ESRF	Experiment title: Probing the 6d polarisation of UO_2 by Resonant X-ray Magnetic Scattering at the uranium M_2, M_3, L_2 and L_3 edges 28 JUN 2000	Experiment number: HE-712
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Report:

Resonant x-ray magnetic scattering (RXMS) is both an element and quantum shell specific magnetic probe. The former characteristic arises from the fact that the incident photon energy is tuned to a specific absorption edge of a constituent atom. The latter via *selection rules*, which govern multipole transitions to empty magnetic states above the Fermi level. The actinides possess a profusion of absorption edges that are in the energy range of diffraction, so that all *5f, 6d, and 7p* polarisations can be investigated by RXMS. Additionally, the *6d* polarisation can be probed from two different core levels: either dipole transitions from the $3p_{1/2}$ and $3p_{3/2}$ levels at the M_2 (E~5.218kev) and M_3 (E~4.311keV) absorption edges, *or* from the $2p_{1/2}$ and $2p_{3/2}$ levels of the L_2 (E~17.150keV) and L_3 (20.911keV) edges. All of these energies can be obtained at the ID20 magnetic scattering beamline of the ESRF. This experimental report describes the results of RXMS at the $L_{2,3}$ and $M_{2,3}$ edges of UO_2. **Figure 1** shows the RXMS intensity at the $M_{3,2}$ (a,b) and $L_{3,2}$ (c,d). These data are shifted to the same energy scale by subtracting the energy position at the maximum of the fluorescence (dashed lines) nominally $\Delta E=0$. The strong dip in the M_3 data (Figure 1a) arises from the interference with the enormous M_4 resonanceat 3.728keV. The M_2 edge data (figure 1b) are more intense than that of the M_3 reaching some 25000cts/sec. Polarisation analysis at these edges established that all of the scattering is $\sigma\pi$ consistent with dipole transitions to the 6d states. These are the fist data obtained at a M_2 edge, to our knowledge. The RXMS data obtained at the $L_{3,2}$ edges are shown in figures 1c and 1d respectively. The polarisation and **Q** dependence, of the L-edge data are also consistent with dipole transitions to the 6d states. Note that the ratio $I(L_3)/I(L_2)$ is close to that found in UPd_2Si_2 [1], but not the same as $I(M_3)/I(M_2)$. However, the strong interference of the M_4 with the M_3 makes more data treatment necessary.

References

[1] D. Wermeille et al. Phys. Rev. B. 58 9185 (1998).

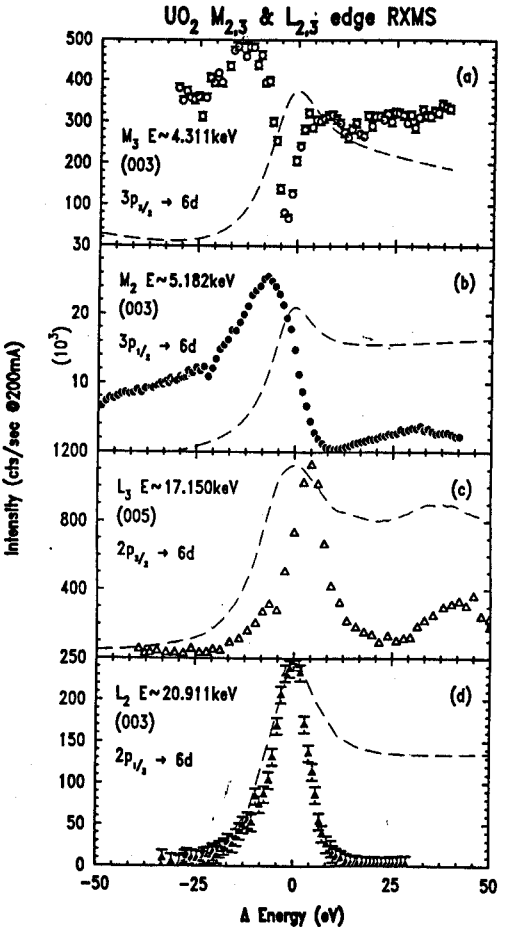

Figure 1. The RXMS of the (003) magnetic reflection at the uranium M_3 (1a), M_2 (1b), L_3 (1c) and L_2 (1d) absorption edges.