XMaS the UK-CRG	**Experiment title:** Magnetic X-ray Diffraction from $MnAu_2$	**Experiment number:** 28-01-80
Beamline: BM 28	**Date of experiment:** from: 26/01/01 to: 29/01/01	**Date of report:** 06/04/01
Shifts: 11	**Local contact(s):** S D Brown	*Received at XMaS:*

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Report:

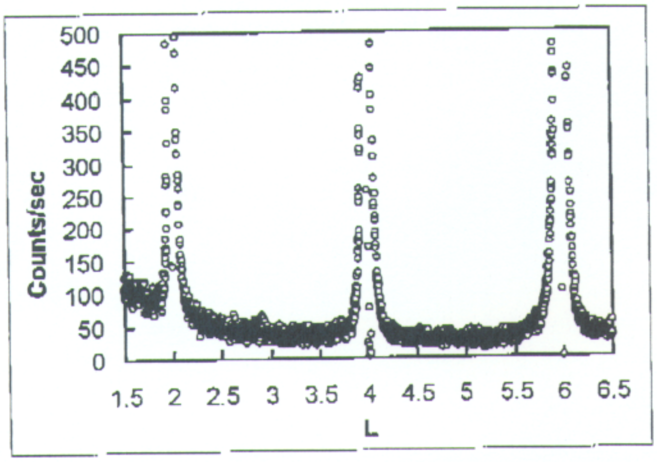
$MnAu_2$ forms an almost close-packed body-centred tetragonal structure, and exhibits a variety of interesting magnetic properties. The low-field, room temperature magnetic structure is a spiral, with Mn moments normal to the *c*-axis and a modulation wavevector along ***c****. The main aim of this proposal was to look for an induced moment on the Au site by exploiting the potentially large dipole-allowed $L_{2,3}$-edge (2p-5d) magnetic resonance. The most severe experimental difficulty arose from the fact that no sample-crystal samples of this material have been successfully produced. We employed an annealed polycrystalline sample, grown School of Metallurgy and Materials, University of Birmingham. This sample was shown by X-ray powder diffraction to consist mainly of the required $MnAu_2$ phase, and by neutron powder diffraction to exhibit the expected magnetic spiral structure.

In order to maximize signal/background, the measurements were performed on a single crystallite of the polycrystal, of approximate dimensions 20 μm x 40 μm perpendicular to the beam direction. The illuminated area of the sample was defined very precisely using a set of in-vacuum incident beam slits, mounted very close to the sample. While no signal was observed at the Au L_3-edge to the level of $\sim 3\times10^{-5}$ of the 002 intensity, we nevertheless achieved remarkably good quality diffraction data from a polycrystalline sample.

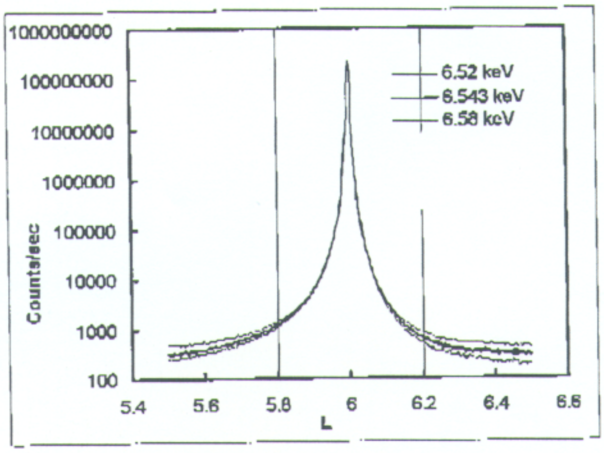
Measurements taken close to the Mn K-edge also showed no magnetic signal, either on or off resonance. While this was to be expected (the K-edge resonance enhancement in 3d

metals tends to be modest, and the non-resonant signal is estimated to be extremely low, at ~10^{-9} of the 006, largely due to the large number of non-magnetic electrons), a signal as weak as 10^{-6} of the 006 intensity, at the magnetic satellite would have been clearly observable.

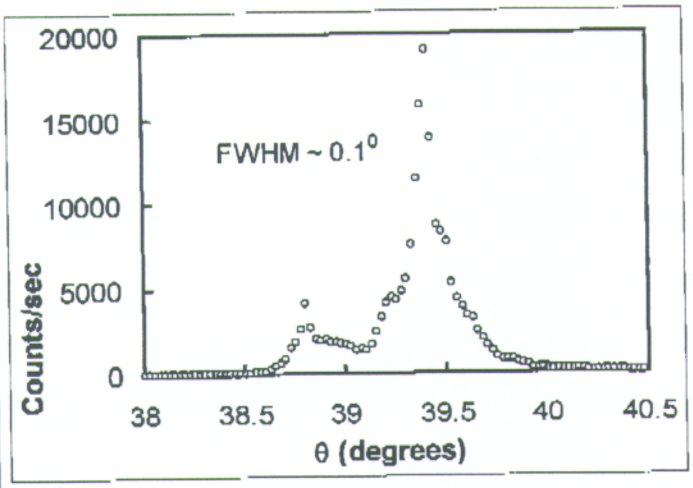
The remarkably good signal/background ratios obtained here, using a single crystallite from a polycrystalline sample suggests that this approach could be very valuable for future studies of magnetic materials, which exhibit stronger magnetic signals.



Diffraction scan through the 002, 004, 006 reflections (detector saturated on the peaks). Energy=6.543 keV (Mn K-edge).



The 006 reflection from $MnAu_2$, measured at three energies close to the Mn K-edge. Vertical lines indicate the positions of the 006±τ magnetic peaks.



A rocking-curve scan of the 006 reflection, indicating that a large fraction of the diffracted intensity originates from a single crystallite of width ~0.1 degrees.