XMaS the UK-CRG	**Experiment title:** Magnetic Resonant Scattering at the K-edges of As and Se in $UAs_{1-x}Se_x$	**Experiment number:**
Beamline: BM 28	**Date of experiment:** from: 15 Sept 1999 to: 21 Sept 1999	**Date of report:** 38-01-38
Shifts: 21	**Local contact(s):** A Stunault	*Received at XMaS:*

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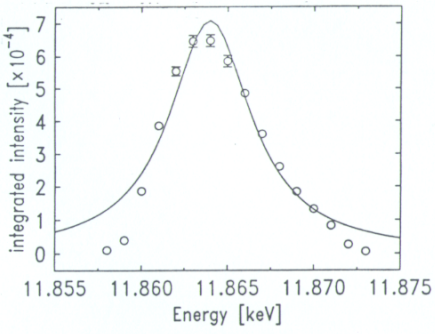
Report:

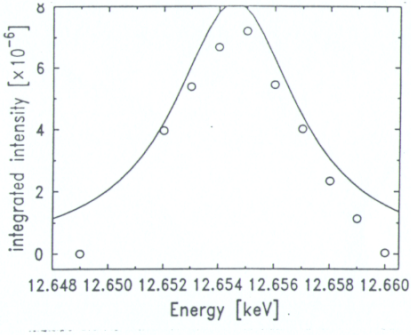
To date most x-ray measurements of actinide materials have concentrated on the resonant x-ray magnetic scattering (RXMS) at the uranium M edges since the 5f uranium levels are magnetic and produce a massively ehanced magnetic signal. We report on measurements of enhanced x-ray scattering at both the As and the Se absorption edges of the $UAs_{1-x}Se_x$ solid solutions, with x=0.1 and x=0.2. Resonant scattering at the anion K edges of these materials is unusual because neutron measurements suggest that the As and Se are non-magnetic. The K absorption edge of As (~12keV) corresponds to excitations of the core *s* electrons. Tuning the photon energy to close to the K edge excites electrons from the core *s* into the *p* shell, and in the actinides the magnetic 5*f* level of uranium the ion mixes with the 4*p* level of the anion (As), which may allow resonant magnetic scattering to occur at the K edge of the anion.

We have investigated the nature of the multipole transitions at the K edges (~12keV) of the anions. Measurements were performed using a LiF crystal for polarization analysis. We studied the magnetic scattering that is present at the (0, 0, 2±**k**) and higher order positions of the type-IA phase which has a magnetic wave vector **k**=1/2.

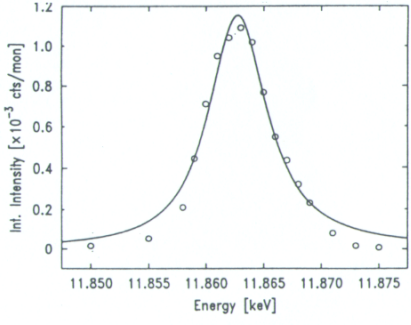
Enhanced scattering was observed at both the As and the Se K edges. The resonant enhancements were large at both K edges, and were observed for all samples. The Figures show $\sigma \rightarrow \pi$ energy scans at the As and the Se K edges for the x=0.1 and the x=0.2 samples. We have determined that the intensity ratio of resonance at the Se and As K edges is proportional to the ratio of the As/Se content. Scattering was measured in the $\sigma \rightarrow \pi$, and no scattering was observed in $\sigma \rightarrow \sigma$. The **Q** dependence of this scattering is consistent with a dipole resonance. The energy dependence of the resonance was as expected for the core hole lifetime at the K edge energy. These preliminary findings suggest that the resonant scattering at the As and Se anion K edges is magnetic in nature.



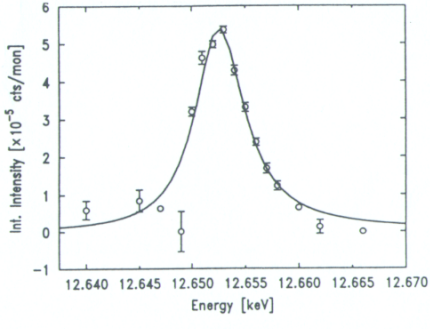
$UAs_{0.9}Se_{0.1}$ As K edge



$UAs_{0.9}Se_{0.1}$ Se K edge



$UAs_{0.8}Se_{0.2}$ As K edge



$UAs_{0.8}Se_{0.2}$ Se K edge