High pressure XANES study of $U_2Zn_{17}$ to 47 GPa

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Introduction

Changes in the charge distribution around a given atom in different chemical and physical environments can alter core-level binding energies and thus produce absorption edge shifts that show up in x-ray absorption near edge structure (XANES) measurements. Our goal was to measure the shift in edge energy of the uranium L$_3$ edge (see Figure 1) in powdered $U_2Zn_{17}$ as a function of pressure at the Advanced Photon Source.

Results

Preliminary analysis of the data shows no clear pressure dependence of the L$_3$ edge of uranium in $U_2Zn_{17}$. The background can be subtracted by fitting to an arctangent function and the peak can be fit to a Gaussian for a more accurate analysis.

![Graph showing absorption edges and pressure dependence](image)

Figure 4. Absorption of $U_2Zn_{17}$ at varying pressure near the L$_3$ edge of uranium. The energy corresponding to the absorption peak is roughly 17.115 eV.

Conclusions

XANES measurements have been performed on the heavy fermion compound $U_2Zn_{17}$ in a diamond anvil cell at pressures up to 47 GPa. The uranium L$_3$ edge has been studied from 3 GPa to 47 GPa and no significant pressure dependence has been observed. A XANES measurement through fluorescence rather than transmission might give higher resolution data making it easier to notice a shift in edge energy on the order of 1 eV.

![Image of U$_2$Zn$_{17}$ sample](image)

Figure 7. A view of the $U_2Zn_{17}$ sample along with a ruby inside the gasket of the pressure cell. The gasket hole is ~75 µm and the diamond anvil is 250 µm in diameter. The sample is ~10 µm thick. An average human hair diameter is about 80 µm.

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