ESRF	Experiment title: Electronic and structural phase diagram of fluctuating valence/Kondo system $CeNi_{5-x}Cu_x$ ($0<x<5$),	Experiment number: HE-256
Beamline: ID9	**Date of experiment:** from: 5.11 to: 11.11.1998	**Date of report:** 30.8.99
Shifts: 18	**Local contact(s):** Michael Hanfland	*Received at ESRF:*

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Report:

Valence fluctuations of rare-earth intermetallics show interesting features involving strong coupling to other physical properties, e.g. lattice vibrations. In particular, Ce intermetallics have attracted attention because Ce can fluctuate between the $4f^0$ and the $4f^1$ states, exhibiting a variety of interesting magnetic and electronic properties. $CeNi_{5-x}Cu_x$ is an ideal case for an investigation of the intermediate valance character of Ce since one can tune the Ce valence by a substitution of Ni by Cu from the strongly intermediate valence state to the local moment Kondo state. Our earlier XAFS experiments indicate that this phase transition lies in the vicinity of x=2.5. It is well known that such a transition can be stimulated by changing external conditions such as temperature and pressure.

We have performed combined X-ray powder diffraction and absorption experiments as a function of external pressure to study the valence of Ce and the influence on the lattice in the vicinity of the phase transition. This allows us to separate the electronic from the lattice effects. The dispersive XANES setup was based on the successfully tested micro-focusing Laue crystal monochromator design presently installed at ID9 for high pressure experiments [1]. A Si(311) monochromator of 0.3 mm thickness and 3 degree asymmetry angle provided a focal spot size below 20 micrometers (M 40:1) and an energy resolution of 7 eV for an angular detector pixel acceptance of 20 microrad (well below the core hole life-time broadening of 10 eV). In order to provide an energy band of 1200 eV, the crystal accepted approximately 6 mm of the horizontal beam. Dispersive XANES spectra have been measured by means of a high resolution CCD detector (Photonic Science) and powder diffraction data have been collected by placing an image plate behind the sample, with the horizontal acceptance narrowed to 0.2 mm, equivalent to an energy resolution of 10^{-3}.

[1] C. Schlulze, U. Lienhart, M. Hanfland, M. Lorenzen & F. Zontone, JSR, Vol. 5, Part 2, (1998).

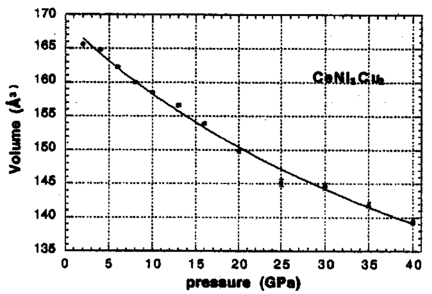

Fig.1 Volume dependence of the lattice of $CeNi_3Cu_2$ as a function of pressure.

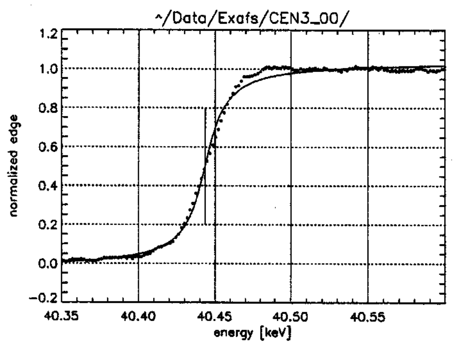

Fig. 2 Ce K-edge spectra of $CeNi_3Cu_2$ at 20 Gpa.