SNBL	**Experiment title:** High pressure studies of metal hydrides. Extreme lattice anisotropy in Cerium Nickel hydride	**Experiment number**: 01-02-325
Beamline	**Date of experiment**: from: 18.04.01 07:00 to: 20.04.01 07:00	**Date of report**: 26.03.02
Shifts: 6	**Local contact(s)**: J. A. Beukes, SNBL	*Received at UNIL:*

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Report:

Purpose:
In this work we studied a new intermetallic hydride, formed by hydrogenation of a compound between nickel and a rare earth metal, cerium. This system, $CeNi_3H_{3.1}$, turns out to be highly anisotropic. The volume expansion accompanying hydrogen absorption in $CeNi_3$ is located solely along one crystallographic axis ([001] direction), giving a record linear expansion of approx. 30%. We wanted to look for possible differences in the compressibility of the lattice along the direction of anisotropy and perpendicular to it.

Results:
Two different sets of experimental data were collected.

1. High pressure studies of compressibility of $CeNi_3D_3$ at applied pressures up to 62 kbar.
2. Thermal decomposition studies of $CeNi_3D_3$ at temperatures between 20 and 200 °C.

A miniature high-pressure (HP) cell was used to load the $CeNi_3D_3$ sample. This cell was mounted on the MAR system at SNBL. Various pressures between ambient pressure and 62 kbar were applied by increasing the load via adjustment screws. The exact pressure was found by means of spectroscopic measurements on a Ruby crystal placed together with the powder sample. For this system we found a distinct displacement of diffraction peaks with increasing pressure, corresponding to a significant compression of the lattice in the [001] - direction. An example of this is given in Fig. 1 (next page), showing diffraction patterns with no pressure applied and under a pressure of 62 kbar.

During heating up to 200 °C all hydrogen is removed from $CeNi_3D_3$, leading to the formation of $CeNi_3$. The mechanism of such decomposition will be studied using the experimental data collected. A completeness of the decomposition is seen by comparison of two data sets collected from the initial $CeNi_3D_3$ sample at room temperature and from the sample heated to 200 °C (Fig. 2)

A detailed analysis of these data is in progress.

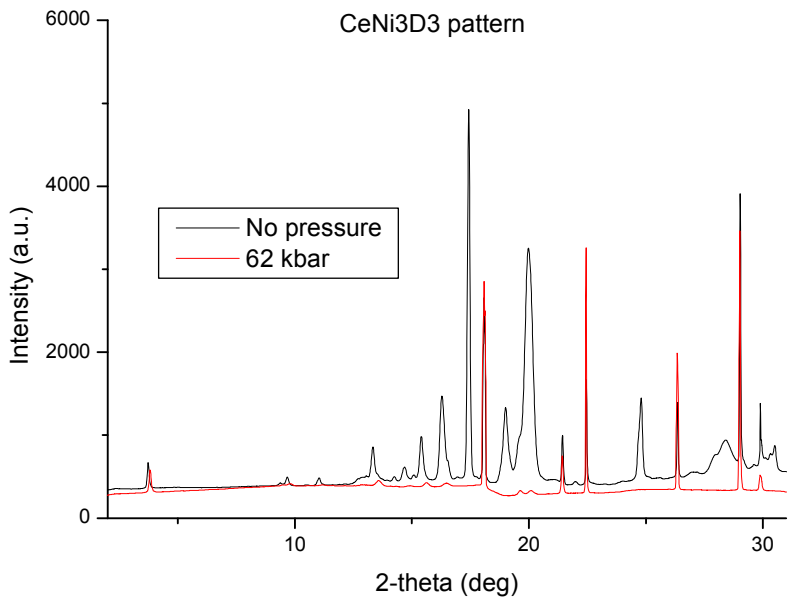

Fig. 1. Diffraction pattern of $CeNi_3D_3$ at ambient conditions and at applied pressure of 62 kbar.

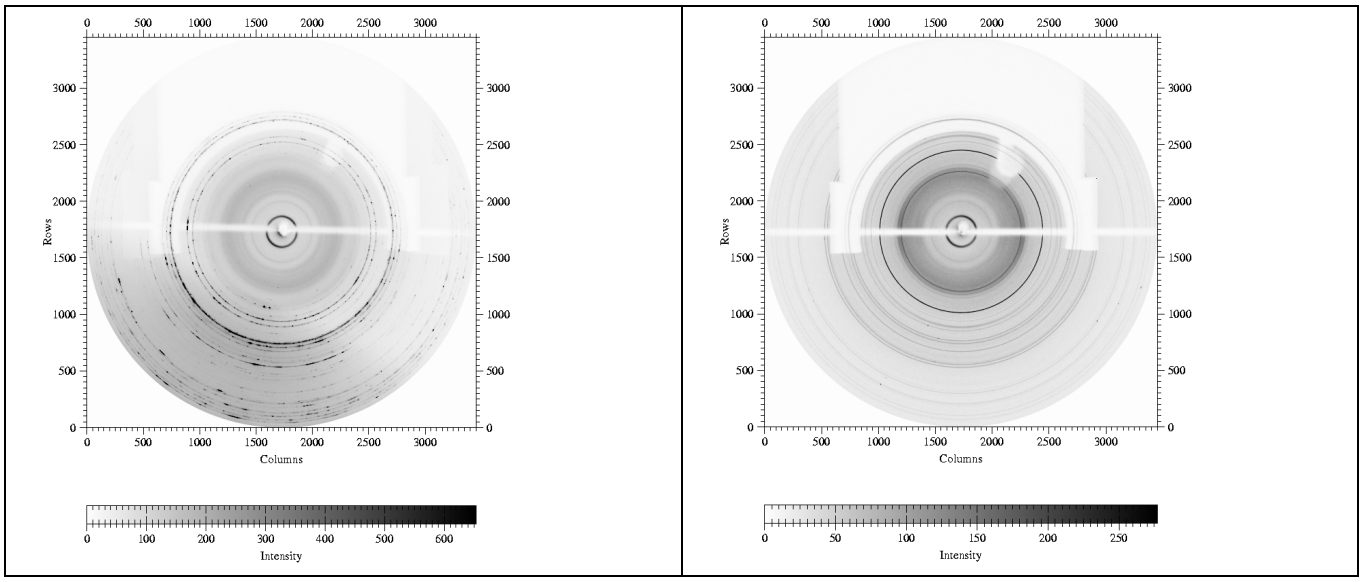

Fig. 2. Diffraction pattern of $CeNi_3D_3$ at 200 °C (left) and at ambient temperature (right).