Lattice Modulation and Charge Ordering Associated with the Spin Ordering in CeP

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1. Introduction

The science of CeP is based on the 4f-electron character. By neutron scattering experiments, SDW was fond under low temperature and magnetic field. Also similar SDW was found under low temperature and high pressure. We expect that it is possible to find superlattice reflections originated from a lattice modulation or a charge density wave associated with the spin wave in CeP. The expected intensity of the superlattice reflection might be 10^{-4}~10^{-5} compared with a fundamental Bragg reflection.

Last term, we reported (1997B0026-ND-np) the development of techniques of 1) focusing of X-ray beam by using a mirror, 2) developing a scanning program in a reciprocal space, 3) testing a low temperature cryostat for a large sample-can which is available for a diamond anvil cell. The purpose of the present work is to measure superlattice reflections in CeP at the low temperature and high pressure conditions.

2. Experimental

X-ray diffraction studies were performed at the Crystal Structure Analysis beam-line (BL02B1) in SPring-8. A single crystal of CeP was settled in a diamond anvil cell. The initial pressure was 0.8GPa, and the sample size was 0.25x0.25x0.45mm^3. The diamond anvil cell was put in a cryostat and cooled down to 8.6K. Double Si 111 monochromators and a double-mirror were used. The wavelength of X-ray was calibrated with CeO_2 powder sample, and was determined to be 0.41334(3)A.

3. Results and Discussion

Since the available beamtime was only two days and there were beam-dump twice, we did not perform the enough experiments. We could measure the Bragg reflections at low temperature and high pressure as shown in the upper part of Fig.1 after the tuning of the position of the sample to the rotation center. As shown in the figure, the intensity of the 800 Bragg reflection is about 1Mcps. We tried to measure the superlattice reflections quickly at the end of the beamtime as shown in the lower part of the figure. The background level is 3cps and the intensity of the superlattice reflection, we expected, might be 100cps so that it should be able to see the peak. However, we could not see the peak as is shown in the figure. Our interpretation is that the pressure changed at the low temperature to be released and then the transition temperature disappeared. The lattice parameter we measured also supported this interpretation. We have to try again this experiment in future to finish the investigation.

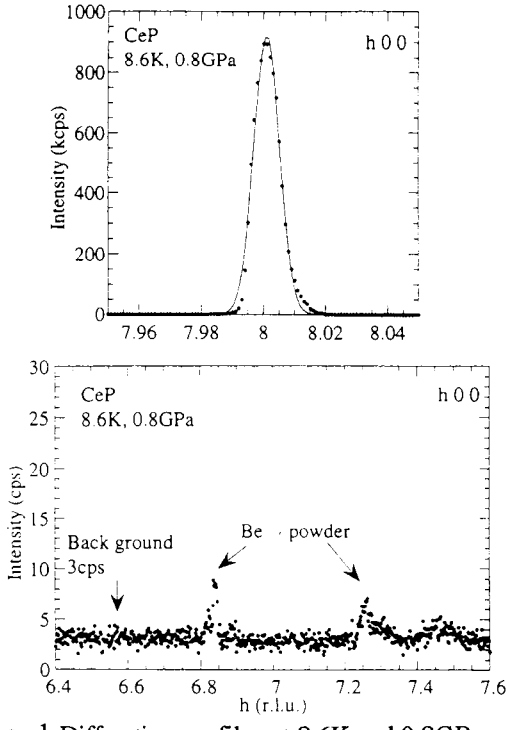

Fig. 1 Diffraction profiles at 8.6K and 0.8GPa.