CROSS TOKAI **Experimental Report** J-PARC	承認日 Date of Approval 2013/5/28 承認者 Approver Takashi Ohhara 提出日 Date of report 2013/5/28
実験課題番号 Project No. 2012I0106 実験課題名 Title of experiment Development of measurement technique under high pressure environments in SENJU 実験責任者名 Name of principal investigator Koji Munakata 所属 Affiliation CROSS	装置責任者 Name of Instrument scientist Takashi Ohhara 装置名 Name of Instrument/（BL No.） SENJU (BL18) 利用期間 Dates of experiments 2012/11/3 – 2012/11/5 2012/12/7 – 2012/12/9 2013/3/9 – 2013/3/13

1．研究成果概要（試料の名称、組成、物理的・化学的性状を明記するとともに、実験方法、利用の結果得られた主なデータ、考察、結論、図表等を記述してください。

Outline of experimental results (experimental method and results should be reported including sample information such as composition, physical and/or chemical characteristics.

Experimental method

High-pressure technique is a powerful tool for physical property measurements and structural analyses as well as other external field conditions, such as magnetic field and temperature. In the field of neutron experiments, measurements under high-pressure conditions are also useful and attractive as well as the other extreme environments such as low/high temperature, magnetic field, electric field, etc.

In this research, we have planned to introduce high-pressure sample environments into SENJU, a single crystal time-of-flight neutron Laue diffractometer, designed for precise crystal and magnetic structure analyses under multiple extreme conditions, constructed at BL18 in MLF/J-PARC.

As shown in Fig. 1, we have prepared two types of compact high pressure cells, one is clamp type piston-cylinder cell made of copper-beryllium alloy which can be expected to reach maximum pressure of about 2 GPa, and the other is clamp type opposite anvil cell which can be expected to reach maximum pressure of about 10 GPa. The most important things to realize high pressure neutron measurements at SENJU is to establish effective method of reducing the back ground (BG) intensity from the high pressure cells. At first, we have investigated the BG of the cells. After the measurements, we have considered how to reduce the BG of the cells at SENJU, and performed the test of the shield step by step. These measurements were performed at atmospheric pressure. We used single crystal as a sample in the cell, to check whether the signal of the sample could be caught through the cell body.

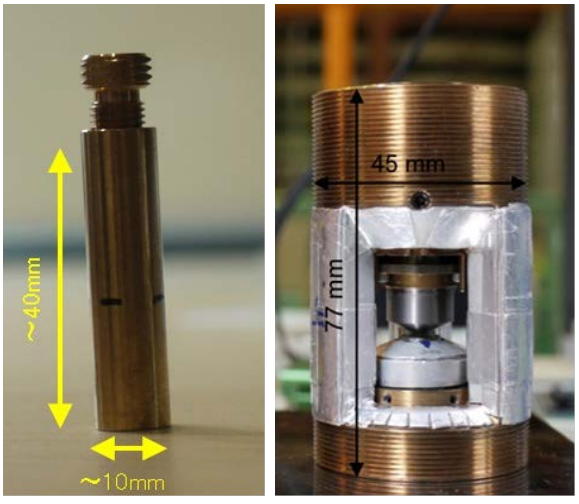

Fig. 1

1．研究成果概要（つづき） Outline of experimental results (continued).

Results

Here after, we will show the result of the piston–cylinder cell. As feasibility test, we tried to perform the measurements by using this pressure cell in SENJU, at atmospheric pressure and at room temperature. A single crystal of NaCl, 1.4x1.3x1.7 mm^3 in size, was enclosed in the pressure cell together with liquid pressure–transmitting medium which was deuterated (D8) glycerol. Fig. 2 shows the setup of the experiments (left) and the diffraction image of NaCl single crystal together with the pressure cell (right). We used rubber made in board–formed B_4C (hole of 3mm in diameter and 5 mm thickness) as an incident beam mask. We found more than fifty Bragg reflections of NaCl through the pressure cell after appropriate exposure time. This result shows that this pressure cell is available enough as one of the high–pressure environment devices of SENJU.

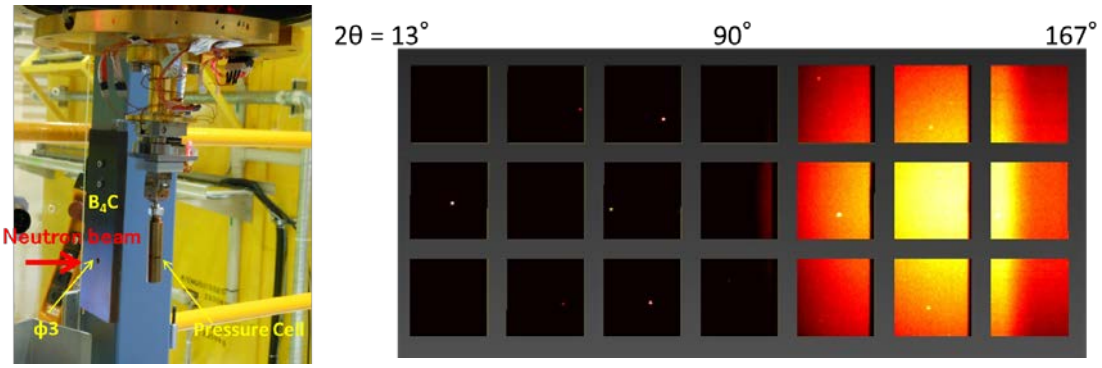

Fig. 2

Receiving the results mentioned above, we have prepared the beak–formed collimator made of BN for incident collimator as shown in fig.3 left. By using this collimator, we were able to reduce BG in back scattering (more than 90 °) region in fig. 2 right effectively as shown in fig. 3 right. In order to obtain the structural analysis data under high pressure, we have measured taurine ($C_2H_7NO_3S$) single crystal. Deuterated (D8) glycerol was used for pressure–transmitting medium and pressure was applied about 1GPa. We are now analysing the data set of taurine under high pressure taking the absorption of the pressure cell into account.

Fig. 3

Through the measurements, we have realized the high pressure sample environments of SENJU. It will be advantage of SENJU in the structural properties research fields. I hope that it will be provided to many users.

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