
 Experimental Report 	承認日 Date of Approval 2014/8/25 承認者 Approver Takashi Ohhara 提出日 Date of report 2014/8/25
実験課題番号 Project No. 2013I0108 実験課題名 Title of experiment Development of single crystal diffraction measurement technique under extreme sample environments at SENJU 実験責任者名 Name of principal investigator Akiko Nakao 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 2014.3.30 9:00 ~ 2014.4.2 9:00

<p>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。</p> <p>Outline of experimental results (experimental method and results should be reported including sample information such as composition, physical and/or chemical characteristics.</p> <p>Among the number of neutron scattering methods, we have had a particular motivation to carry out single-crystal diffraction experiments under pressure. Although the maximum pressure for single-crystal neutron diffraction for the sake of structure refinement currently reached up to 10 GPa by using the Paris-Edinburgh press, the actually refinable samples by using the set-up are still restricted by the limited accessible reciprocal space due to the narrow gap of opposed anvil cell. piston-cylinder apparatuses, in that sense, have an ideal geometry, since the apparatus has a wide opening accessible direction for incoming and scattered neutron if the cylinder material is well transparent for neutron.</p> <p>As the material of the new piston-cylinder cell, we have focused on the bulk metallic glasses (BMGs), which has making rapid progress in the last 20 years owing to its strong motivation for engineering application, have ideal properties as a cylinder material in terms of exceptional tensile strengths, and no sharp Bragg peaks. Among the tremendous kinds of BMGs, we have taken notice of Zr-based BMGs, because 1) Zr has a better transparency for neutron in the main elements of BMGs and 2) Zr-based BMGs exhibit significant plasticity, which is important factor for a safety issue in neutron facility to avoid a catastrophic rupture.</p> <p>Neutron diffractions for a cast rod of Zr-based BMG with a diameter of 12 mm and a length of 15 mm which will be used as a cylinder material and the empty piston-cylinder made of CuBe alloy with outer/inner diameters of 8.8/2.5 mm as a reference were measured at SENJU. The exposure times were 20 min and 5 min, respectively, whereas the beam power during the run was around 300 kW. It is confirmed that the Zr-based BMG is amorphous; no sharp Bragg peaks are found in the pattern (Fig.1 (a)), except the first sharp diffraction peak (FSDP). On the other hand, lots of peaks with a slight texture are observed for CuBe cylinder (Fig.1 (b)).</p>
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1. 研究成果概要(つづき) Outline of experimental results (continued).

The merit of Zr-based BMG to CuBe is obvious in terms of less parasitic scattering, as the FSDP is easily distinguishable to Bragg spots from a single crystal sample.

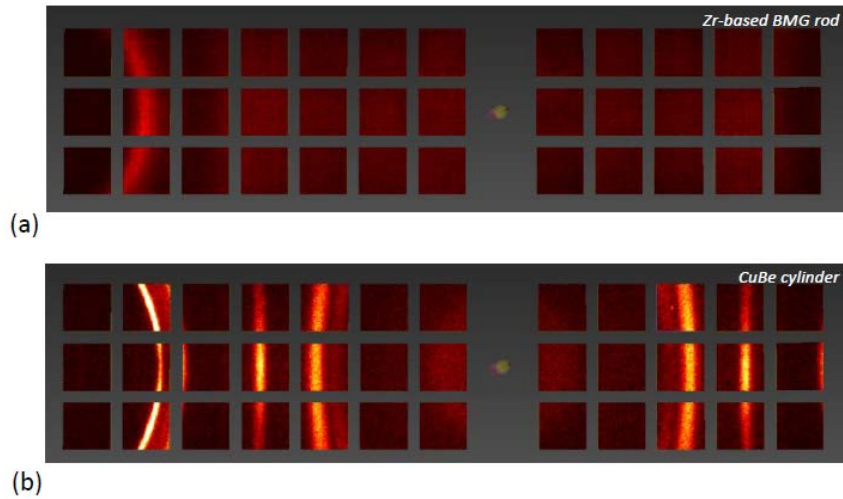


Figure 1. Comparison of neutron diffraction for (a) a rod of Zr-based BMG and (b) an empty cell made of CuBe, taken at SENJU. The 2D images are drawn at a certain time bin.

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