MLF Experimental Report	提出日 Date of Report 2017/2/13
課題番号 Project No. 2016A0106 実験課題名 Title of experiment The trial of neutron diffraction imaging using a high-resolution WLSF-scintillator detector 実験責任者名 Name of principal investigator Takuro Kawasaki 所属 Affiliation Japan Atomic Energy Agency	装置責任者 Name of responsible person Kenichi Oikawa 装置名 Name of Instrument/(BL No.) NOBORU (BL10) 実施日 Date of Experiment 2016/12/5-12/7

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

1. NaCl single crystal, 7 mm x 8 mm x 10 mm
2. β-Sn Single crystal, ϕ10 mm x L10 mm
3. Steel plate, t0.5 mm x 20 mm x 100 mm

2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。)
Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

[Method]

The sample stage and the high-resolution wavelength shifting fiber scintillator detector were set up on the stage of NOBORU with the diffraction angle 2θ of 90° as shown in Fig. 1. The distances between the beam slit and the sample position was 425 mm, and between the sample position and the detector was 70 mm. The difference of the sensitivity of each pixel was corrected by the incoherent scattering intensity from a polyethylene block. The diffraction intensities were recorded using a READOUT module and a VME-CPU module as event data.

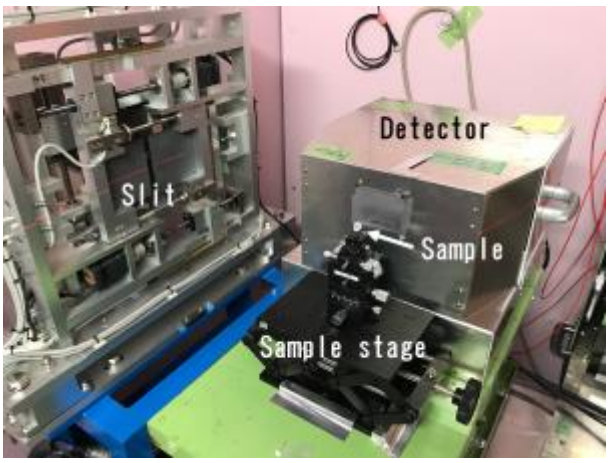

Fig. 1. Experimental set up

2. 実験方法及び結果（つづき） Experimental method and results (continued)

[Results]

a. β −Sn Single crystal

Fig. 2 (a) shows diffraction intensity map of 100 reflection from a part of the sample with the width of 1 mm. The spatial resolution of this measurement is estimated to be about 200 μm from the beam divergence. Bright parts and dark parts in the map indicate the distribution of sub grains in the sample. The time−of−flight (TOF) diffraction profiles of three areas in the map are plotted in Fig. 2 (b). In the profile of the bright part (area 3), only one peak, whose TOF is almost same as the peak of sum of the whole area (area 1), is found. On the other hand, in the profile of the dark part (area 2), there are three peaks at TOF = 13400 μs, 13800 μs and 14200 μs. In addition to this, the intensity of these peaks is significantly smaller than the intensity of the peak of area 3. For that reason, in the dark part, there are small grains which have different orientation.

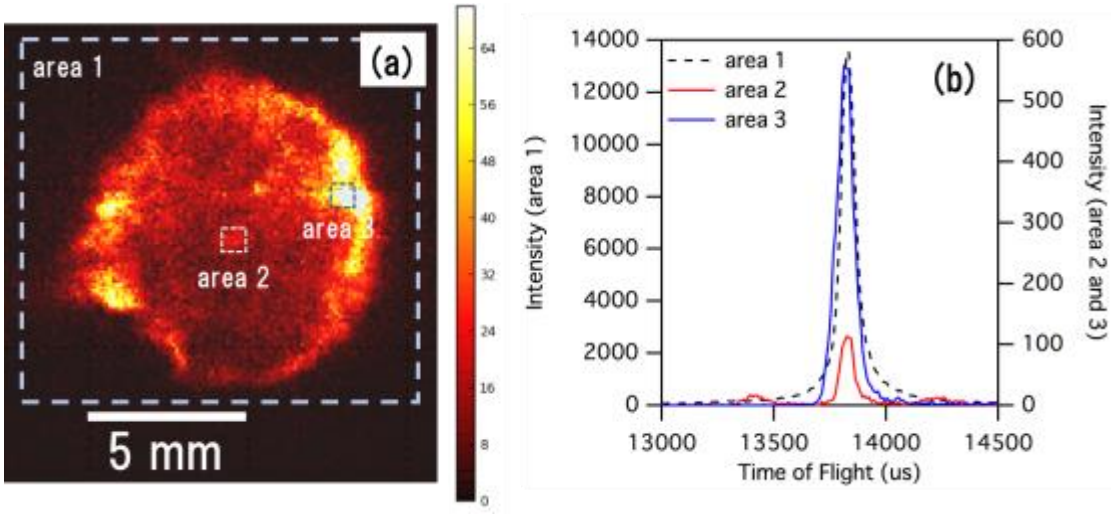

Fig. 2. (a) Diffraction intensity map of 100 reflection from the part of β −Sn single crystal with the diameter of 10 mm. The gauge thickness was set to be 1 mm by the beam slit. (b) TOF profiles of 100 reflection from the whole of the gauge, the bright part and the dark part of the map.

b. Steel plate

In general, the polycrystalline material which consists of small particle gives homogeneous distributed diffraction intensity, which is called Debye−Scherrer ring. However, if the particle size is relatively large, the inhomogeneous intensity distribution can be observed. By using the high−resolution 2−dimensional detector, the position of the particle with the particular crystal orientation can be detected. In the present measurement, the distribution of crystal grains which <100> orientation is normal to the plane in the steel plate with the large grain size of around 200 μm was visualized as shown in Fig. 3. Because the resolution is not high enough, the size of the grains could not be evaluated.

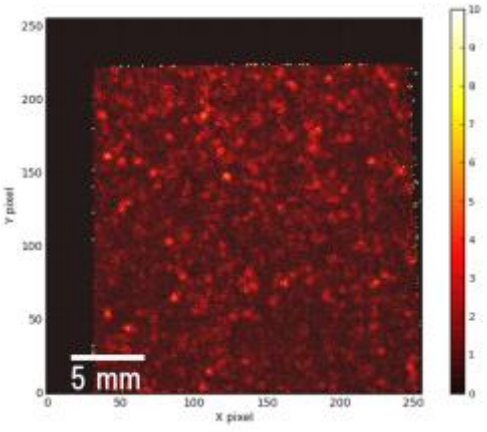

Fig. 3. The positional distribution of the <100> grains in the steel plate.