MLF Experimental Report	提出日 Date of Report **2014.1.21**
課題番号 Project No. **2012P0006** 実験課題名 Title of experiment **Measurement of Texture and Dislocation Density by using iMATERIA** 実験責任者名 Name of principal investigator **P.G. XU, Tetsuya Suzuki** 所属 Affiliation **Japan Atomic Energy Agency**	装置責任者 Name of responsible person **T. ISHIGAKI, A. HOSHIKAWA** 装置名 Name of Instrument/（BL No.） **iMATERIA** 実施日 Date of Experiment **2012.4.19, 2013.3.12**

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) Cold rolled low carbon steel, Fe-0.1mass%C, 10mm × 10mm × 10mm
(2) Annealed low carbon steel, Fe-0.1mass%C, 10mm × 10mm × 10mm
(3) Multiphase steel, Fe-18mass%Ni-0.1mass%C, 10mm × 10mm × 10mm
(4) Magnesium alloy AZ31, Mg-3.0mass%Al-1.0mass%Zn, 10mm × 10mm × 10mm
(5) IF steels after different tensile deformation and aging treatments, Fe-30ppmC, ϕ6mm×10mm

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.

The rapid texture measurement of bulk metallic materials is required not only for the precise formability control of commercial sheet products, but also for the thermomechanical process optimization of new materials. Different with the angle dispersive neutron diffraction with a single-tube/1-D neutron detector, the time-of-flight neutron diffraction enables to measure various whole diffraction patterns of a textured material simultaneously at different scattering angles using different neutron detectors. At J-PARC center, iMATERIA time-of-flight neutron diffractometer (Fig.1) was being employed to establish a reliable technical environment for rapid bulk texture measurements. In addition, iMATERIA was also being employed to evaluate the microstructure characteristics of non-textured and textured metal

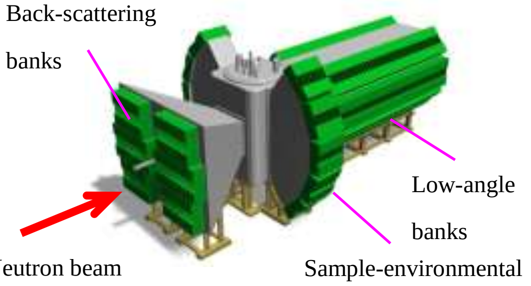

Fig.1 iMATERIA neutron diffractometer

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

materials along different orientations, including dislocation density distribution.

The back-scattering detector banks, the sample-environmental detector banks and the low-angle detector banks were primarily divided into 6, 6, 12 detector groups, respectively, and the neutron event-type neutron diffraction information from each detector group was utilized to compose an independent neutron diffraction pattern. An omega-axis rotatable sample exchanger with 30 sample holders was employed to control the sample rotations. As a fundamental measurement, 10×10×10 mm^3 cubes of a cold rolled low-carbon steel and a martensite-austenite multilayer multiphase steel as reference samples were rotated to different orientations with ω=0, 30, 45, 60, 90, 120, 135, 150 degrees to collect the crystallographic orientation information. Rietveld texture analysis was carried out using the MAUD (materials analysis using diffraction) software technique.

Fig.2 showed the neutron diffraction patterns of cold rolled low carbon steel collected from the BS bank, together with the relative change in full width at half maximum (FWHM) with the omega-axis rotation. The changes in peak intensity revealed a strong texture effect. The relative changes in FWHM evaluated with the following formula $(FWHM_{\omega}-FWHM_{\omega=0})/FWHM_{\omega=0}$ suggested that the dislocation density in the bulk sample has some orientation-dependent distribution characteristics, needing to be further investigated.

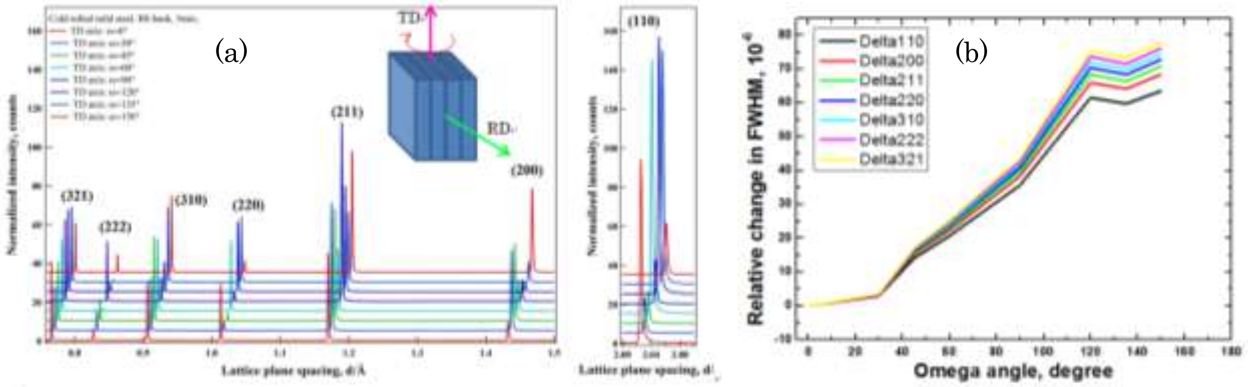

Fig.2 Neutron diffraction patterns (a) and the relative change in FWHM of diffraction peaks (b).

Fig.3 showed the sample exchanger, the diffraction data coverage in an equal area pole figure projection and an example of the recalculated pole figure. The recalculated martensite (110) pole figure from the total 192 neutron diffraction full patterns (24 patterns × 8 rotations) of a martensite-austenite multilayer multiphase steel sample showed a cold rolled texture similar to a martensite monolithic steel. In order to reduce the measurement time and improve the reliability, the proper refinement of detector stereographic coverage range and the corresponding increment of independent diffraction patterns from different sample orientation are under investigation.

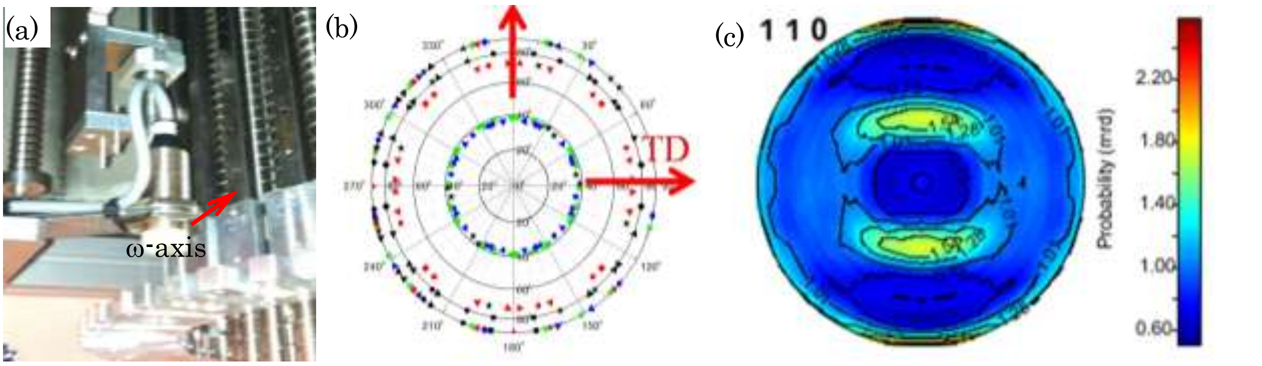

Fig.3 (a) Sample exchanger, (b) diffraction data coverage in an equal area pole figure projection, and (c) recalculated (110) pole figure of martensite layers in the multiphase multilayered steel.