MLF Experimental Report	提出日 Date of Report 2015.1.13
課題番号 Project No. **2014P0008** 実験課題名 Title of experiment **Rapid Measurement of Texture by using iMATERIA** 実験責任者名 Name of principal investigator **P.G. XU** 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 **2014.5.20; 2015.4.16**

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) Cold rolled aluminum alloy, Al-0.20Si, 10mm ×10mm ×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.

For modern automobile, civil engineering and other industries, the high value-added structural metallic plates and sheets with lower energy consumption and longer service life expectancy have been emphasized than ever, and the simultaneous microstructure and crystallographic texture control is thought as an important way to develop new high strength high formable materials sheets. In these years, the iMATERIA/TAKUMI bulk texture measurement environments using neutron diffraction have been primarily established at J-PARC, trying to meet the commercial structural material R&Ds and the fundamental applied researches. By using multiple oriented neutron detectors, the time-of-flight neutron diffraction enables to measure various whole diffraction patterns of a textured material simultaneously at different scattering angles, and to evaluate the microstructure characteristics of non-textured and textured multiphase materials along different orientations, including dislocation density distribution and phase volume fraction.

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

The back-scattering detector banks (2θ=145~175°), the sample-environmental detector banks (2θ=80~100°) and part of the low-angle detector banks (2θ=20~40°) were primarily divided into 76, 96, 120 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 was employed to control the sample rotations along its normal direction. As an examination to iMATERIA texture measurement instrumental characteristics, 10×10×10 mm^3 cubes of an aluminum alloy and a magnesium alloy were employed here as the reference materials. Rietveld texture analysis was carried out using the MAUD (materials analysis using diffraction) software technique.

By using the large solid angle coverage of position-sensitive detectors at iMATERIA neutron diffractometer, the rapid bulk texture evaluation environment has been established and the multiphase texture measuring time can be reduced by at least an order of magnitude. Fig.1 compared the neutron diffraction pole figures recalculated by using two neutron diffraction instruments, where the complete pole figures of the aluminum alloy were measured at TAKUMI by using χ/ϕ axis rotation and the incomplete pole figures were measured at iMATERIA by using 4 times of ω axis rotation only. Fig.1 confirmed that the good reliability for iMATERIA texture measurement has been achieved by referring the corresponding results obtained from TAKUMI.

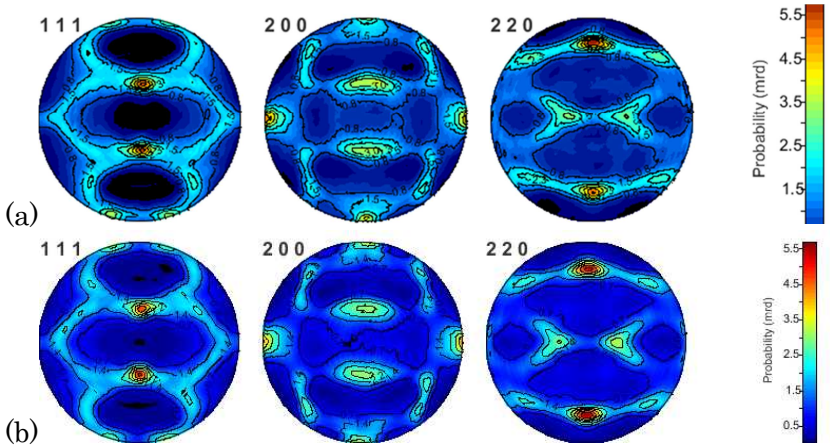

Fig.1 Comparison between recalculated pole figures of cold rolled aluminum alloy obtained by time-of-flight neutron diffraction from TAKUMI (a) and iMATERIA (b).

Fig.2 showed the iMATERIA orientation distribution function (ODF) of the magnesium alloy by comparing with our previous result from MUSASHI angle dispersive neutron diffractometer. These quite similar suggested again that iMATERIA is possible to be applied to general texture measurement, though some improvement seems necessary for simplifying texture analysis process.

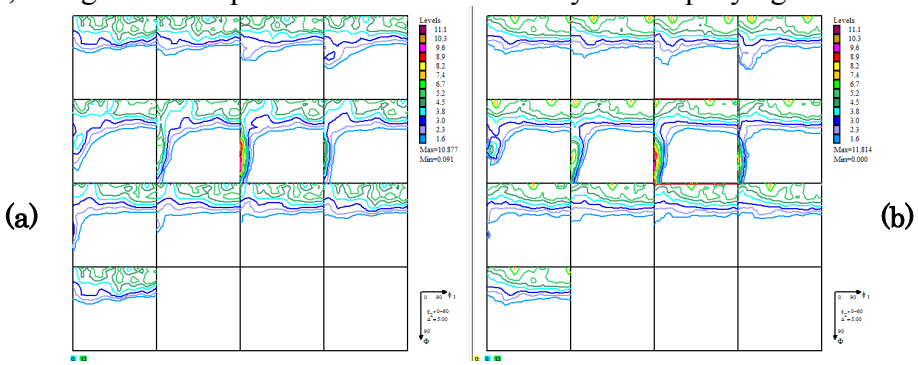

Fig.2 ODF comparison of a magnesium alloy obtained by (a) iMATERIA time-of-flight neutron diffraction and (b) MUSASI-L angle dispersive neutron diffraction at JRR-3.