 MLF Experimental Report	提出日 Date of Report May 13, 2015
課題番号 Project No. 2014B0296 実験課題名 Title of experiment Dislocation density/structure and texture evaluation at elevated temperature for steels 実験責任者名 Name of principal investigator Yo Tomota 所属 Affiliation Ibaraki University	装置責任者 Name of responsible person Kazuya Aizawa 装置名 Name of Instrument/(BL No.) TAKUMI (BL19) 実施日 Date of Experiment March 10 – 14, 2015 (3 days)

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.

Tension-compression specimens for elevated temperature tests were prepared.

(M12 (screw) x 94 mm length; gauge portion is 6 mm in diameter and 10 mm in length)

- (1) SUS310(Fe-25Cr-20Ni) alloy
- (2) Fe-33Ni alloy
- (3) Fe-2Mn-0.2C alloy
- (4) Fe-30Ni-20Co alloy

All of the tests were finished before fracture.

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 set-up for high temperature deformation was shown below. During tension or compression deformation, heating and cooling, diffraction profiles were recorded in the axial and radial directions.

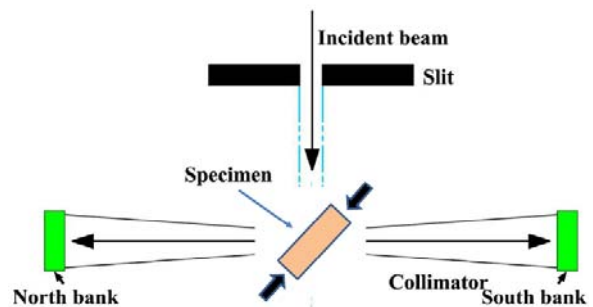
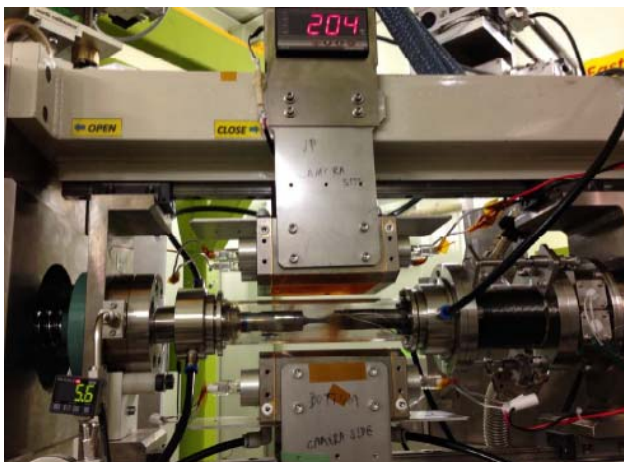


Fig. 1 Experimental set up at TAKUMI: (a) instrument appearance and (b) top view of beam alignment.

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

The obtained profiles were analyzed using the Z-Rietveld and CMWP software to obtain changes in phase fraction (transformation), texture, dislocation density etc. during processing. The main purpose of the present experiment includes how dislocation density, character and arrangement can be determined by this procedure.

Typical results obtained for SUS310 steel are presented in Fig. 2. A specimen was first deformed in tension successively by 5, 10, 20 and 40%, heated to 373 K to 1073 K and then cooled to RT. In Fig. 2, the averaged dislocation density evaluated by the CMWP line fitting was plotted. Changes in dislocation character (ratio of screw and edge dislocation-components, arrangement parameter etc. were tracked during deformation and annealing. The averaged dislocation density increases with plastic deformation and decreases with annealing. Important is that the quantitative density can be determined in situ at elevated temperatures. The influence of

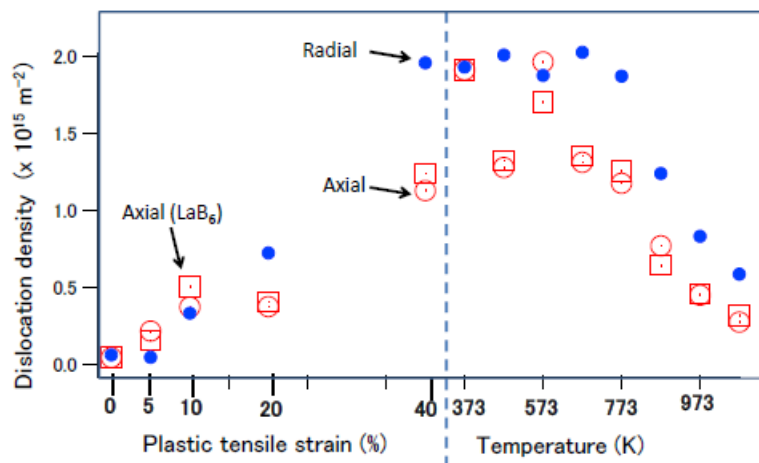


Fig. 1 Experimental set up at TAKUMI: (a) instrument appearance and (b) top view of beam alignment.

standard profiles (compare red circle (annealed steels) and red square (LaB6)) was found small. The discrepancy between the results from the axial and radial directions is now under discussion. Another important results obtained includes that dislocation density in individual $\langle hkl \rangle$ oriented grains family can be evaluated and revealed they are nearly identical in the radial direction but very different in the axial. This means the dislocation density in individual grain is different from each other in the tensile direction, which should be taken into account for work-hardening

mechanism of polycrystalline fcc metals and alloys.

The Fe-33Ni alloy was heated to 1273 K, then cooled down to 923 K. After holding there for 20 min, compressed by 40% isothermally kept for 60 min to monitor recovery and recrystallization behavior. The deformation temperature of 973 K was examined in the previous beam time and the results were reported in CAMP ISIJ, 27(2014), 833. The present data are now under analyses. Because the holding time is lowered in this time, clear understanding is expected to be worth for publishing in the journal.

A series of work on ferrite transformation in Fe-Mn-C(-Nb) steels was continued and the effects of Nb addition and austenite deformation have been investigating. This time, dynamic transformation at 813 K was performed to make clear the texture evolution behavior which was puzzling in the past experiments at ISIS. The detailed consideration is now on going. The application of the CMWP fitting will be also performed to discuss the role of dislocation density/structure in ferrite transformation.