MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2012A0114 実験課題名 Title of experiment Residual stress distribution in mechanical parts made by a new forging technique 実験責任者名 Name of principal investigator Y.Tomota 所属 Affiliation Ibaraki University	装置責任者 Name of responsible person Yo Tomota 装置名 Name of Instrument/(BL No.) BL19 Engineering diffratometer TAKUMI 実施日 Date of Experiment April 13-15, 2012

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.

Specimens made from Fe-C alloy (S45C) and pure Cu shown below were used for the measurements. They were prepared either by simple compression or partial diameter-enlarging, so called "Jikuhidai" method.

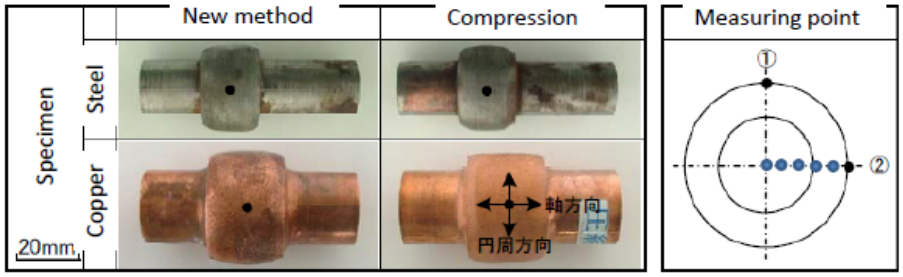

Fig. 1 Specimens used and measuring points from the center to the surface.

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 elastic strains in the three directions were determined at every 2mm point from the center to the outside surface (see the right figure in Fig. 1), where the gauge volume was adjusted to be 2 by 2 by 2 mm. A sample was set on the Euler cradle in such a way that the diffraction profiles in the orthogonal three directions could be obtained without resetting (see Fig. 2). Examples of diffraction profiles are presented in Fig. 3. The bottom profile was for a coupon and those of several points from the center towards the outside surface were drawn in order, indicating the presence of texture. Then, the measurements were performed at 2mm deep from the surface and lattice parameter determined using the Z-Rietveld software was plotted around the circle for the partially diameter-enlarged S45C specimen. As seen, the axial residual strain seems to show some angle dependence.

Fig. 2 Specimen setting at TAKUMI

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

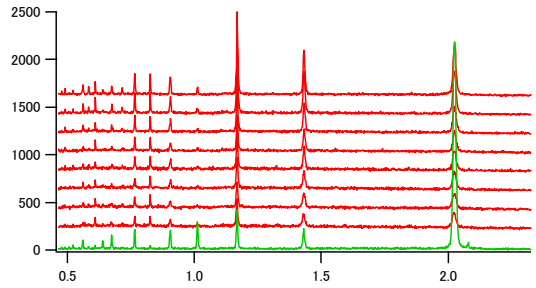

Fig.3 Diffraction profiles obtained: From the bottom to the top, a coupon and then the center to the surface for S45C.

Elastic strains were determined and then putting the obtained strain s into the Hooke equation, the residual stresses were calculated. Here, taking the texture issue into concideration, the shift of (211) peak was adopted to determine elastic strain and the residual stresses calculated were presented in Fig. 5. In case of the simple compression specimen (a), compressive stresses exist in the central region of the specimen while the hoop and axial stresses change to tensile near the surface. Similar results were observed in the partially diameter-enlarged specimen although the amplitude of compression stresses inside the specimen is lower, suggesting that this new forging method yields lower residual stresses. .Further analyses on the distribution of FWHM and texture are now under investigation..

The residual stresses determined for the partially diameter-enlarged Cu specimen show somewhat different results but the experiments on the simple compression Cu specimen could not be made because of the limited beam time.

The present results are nearly consistent with those obtained by the angular neutron diffraction at HANARO/KAERI and much more information including texture could be obtained by this experiment.

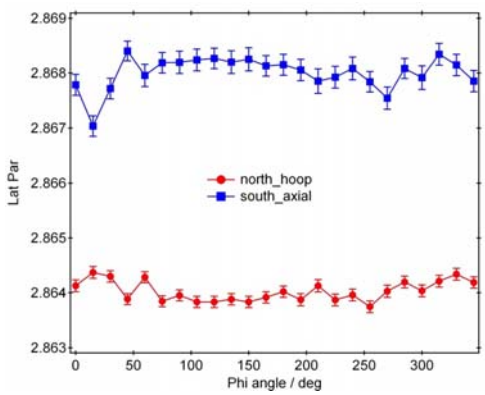

Fig.4 Change in lattice spacing as a function of the angle from ① to the direction toward ② in Fig. 1.

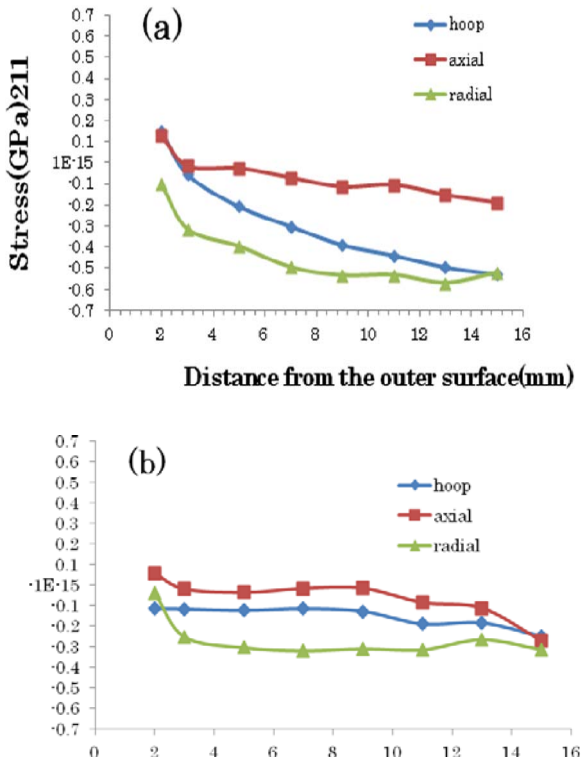

Fig. 5 Residual stresses obtained for simple compression (a) and partial diameter enlarging (b) for S45C.