<table>
<tr><td>MLF Experimental Report</td><td>提出日 Date of Report</td></tr>
<tr><td>課題番号 Project No.
2008A0044
実験課題名 Title of experiment
Stress/Strain Effects on Industrial Superconducting Composites
実験責任者名 Name of principal investigator
Stefanus Harjo
所属 Affiliation
J-PARC Center, JAEA</td><td>装置責任者 Name of responsible person
Kazuya Aizawa
装置名 Name of Instrument/（BL No.）
BL19
実施日 Date of Experiment
2009.01.27 – 2009.02.22 (total 6 days)</td></tr>
</table>

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.

$YBa_2Cu_3O_7$ (YBCO) tape

$Bi_2Sr_2Ca_2Cu_3O_{10}$ (BSCCO-2223) tape

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.

1) Internal strain in YBCO tape during tensile loading

The YBCO tape (4mm width) used in the measurement had a total thickness of about 100μm with only 1μm thick YBCO layer. This tape used a Hastelloy substrate with about 40μm thick, and was laminated by 20μm thick Cu layers at both sides. Two YBCO tapes were superposed and were set at the loading machine in such a way that the loading axis was in the scattering plane and to be 45 degree to the incident beam direction (see Fig. 1 left). TAKUMI had only 1 detector module for each 90 degree scattering bank, and the beam power was 20kW, during the experiments. Diffraction profiles were collected for 7.2ks. The 2-D diffraction pattern was collected at the north 90 degree scattering bank, i.e., data for grains oriented along tensile direction. It was obviously seen that peaks from YBCO phase (020 and 200 peaks) were identified at only around 2θ of 90 degree, showing a very strong texture. The data were then re-binned and time-focused again for a 2θ range of 87.5 to 92.5 degrees, to get diffraction patterns having enough statistics to analyze. The analyzed data is shown in Fig. 2. YBCO grains deforms elastically with respect to the external load, as far as the metal parts deforms elastically,

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

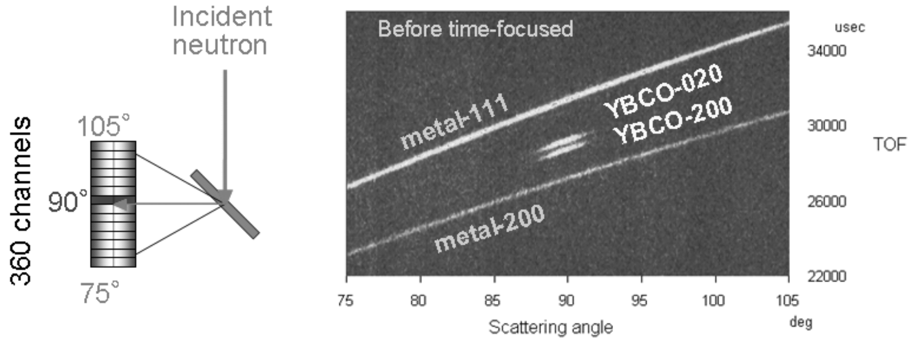

Fig.1 Schematic geometry of YBCO tape setting for neutron diffraction measurement during tensile deformation (left), and 2-D diffraction pattern of YBCO tape at the north 90 degree scattering bank (right). Time focusing manipulation was not performed to the 2-D diffraction pattern data.

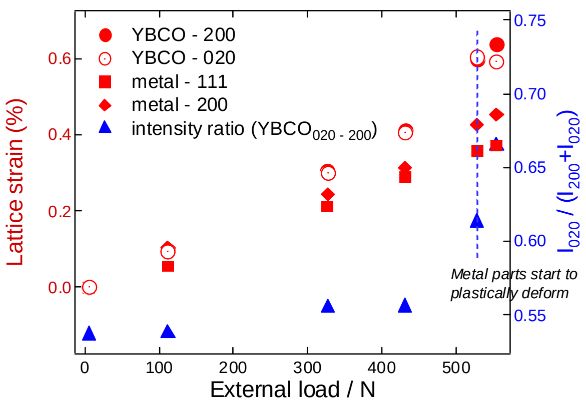

Fig.2 Lattice strain and the integrated peak intensity ratio of YBCO-020 and YBCO-200 with respect to external load

and start to plastically deform when the metal parts deform plastically. This result is surprising, since YBCO is brittle and only has 1μm thick. Moreover, the integrated peak intensity ratio of YBCO-020 and YBCO-200 changes with increasing the external load suggesting that domain switching may occur.

2) Internal strain in BSCCO tape during tensile loading

Internal strains changes in BSCCO tape with respect to the applied load are shown in Fig. 3. In diffraction pattern for the longitudinal direction of the tape, only 220 peak was mainly observed for BSCCO phase. This indicates that c-axis of BSCCO is almost perpendicular to the longitudinal direction, i.e., parallel to the tape surface.

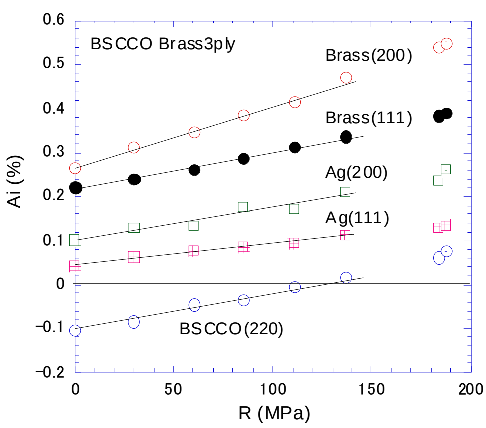

Fig.3 Applied stress dependence of local strains exerted on each component in the Brass3Ply BSCCO tape

In BSCCO, internal strain of 220 was observed to be compressive before loading, and it changed to be tensile with increasing tensile loading. The compressive internal strain is thermal residual strains induced during the heat treatment process. The value of applied stress when the internal strain becomes zero is approximately 125 MPa. This stress value correspond to a strain value of 0.081%, considering the BSCCO Young's modulus of 150 GPa.