MLF Experimental Report	提出日 Date of Report **2017.6.19**
課題番号 Project No. **2016A0316** 実験課題名 Title of experiment **Anisotropic plastic deformation and bulk texture evolution of multiphase multilayered steels towards new generation high strength high formability automobile steel sheets** 実験責任者名 Name of principal investigator **Pingguang XU** 所属 Affiliation **Japan Atomic Energy Agency**	装置責任者 Name of responsible person **T. Ishigaki, A. Hoshikawa, Y. Onuki** 装置名 Name of Instrument/（BL No.） **iMATERIA (BL20)** 実施日 Date of Experiment **2016.12.5-7.**

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. WT780C, as-quenched monolithic low-carbon martensite steel sheet.
2. IF steel, ferrite monolithic steel sheet.
3. 3 Layers (SUS316/WT780C/SUS316), austenite/martensite/austenite multilayered steel sheet.
4. 3 Layers (SUS316/14Ni-Fe/SUS316), austenite/martensite/austenite multilayered steel sheet.
5. Duplex steel SUS329J1, austenite/ferrite duplex steel sheet.

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.

In the previous study, the martensite in multilayer steels was found to have an interesting phenomenon about the orientation splitting (ε=5~10% tensile strain) and the gradual reorientation (ε>15% tensile strain) in {111}<hkl> fiber component, which is different with the texture evolution of ferrite in IF steel. It seemed due to the phase stress partitioning and the multiphase interlayer constraint. However, considering that the initial textures for the martensite in multilayered steel sheet and the ferrite of monolithic steel sheet were different, considering that their microstructure morphology were much different, a further experimental confirmation was essential to confirm such new phenomenon using iMATERIA neutron diffraction.

Moreover, in order to confirm the effect of the multilayered interlayer constraint, it is necessary to examine the texture evolution using a ferrite/austenite duplex steel sheet, such as SUS329J1 with well-known pancake ferrite morphology, though the initial texture and tensile strength level was a little different with the austenite/martensite multilayered steel sheet.

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

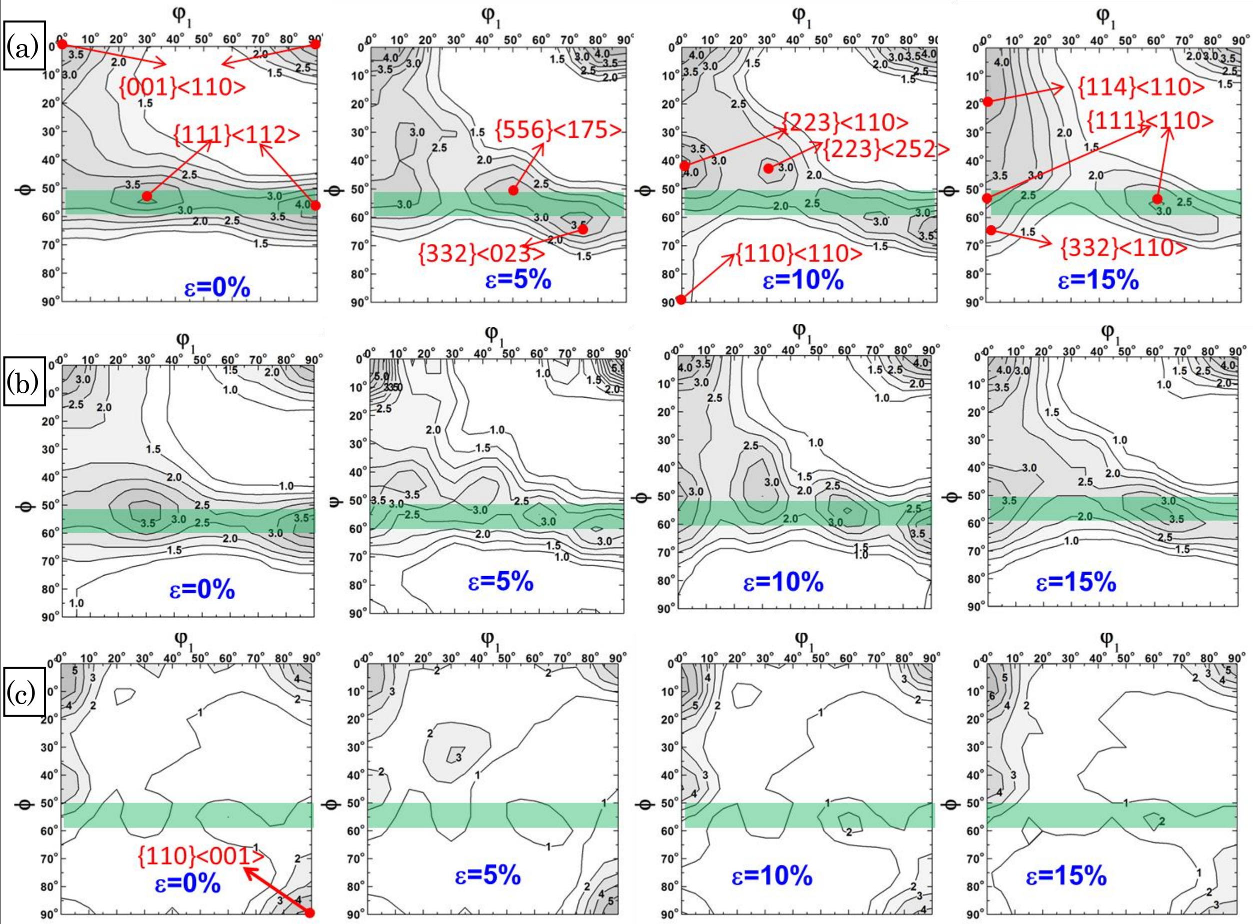

Fig.1 Comparison of texture evolution process between martensite in multilayered steel sheets (a: previously measured using TAKUMI; b: measured using iMATERIA for confirmation) and ferrite in SUS329J1 duplex steel sheet (c: ferrite in layer or pancake-like morphology). The green band zone denotes {111}<hkl> or gamma texture fiber, which is an ideal orientation fiber to realize a good plastic anisotropy or deep drawability.

In the above Fig.1, though the initial textures of martensite obtained from different steel sample using TAKUMI (a) and iMATERIA (b) have some difference, the general evolution trend during the tensile deformation is much similar. Before the tensile deformation, the cold rolled texture characteristics of {001}<110> and {111}<112> were both clear though the steel sheets were solution treated and then quenched. During the ε=5~10% tensile deformation, it was confirmed that orientation splitting related to the formation of non-ideal and unstable texture components took place in a way of inclined crossing the gamma fiber, and the unstable orientations were confirmed to rotate to {111}<110> component after ε>15%. In addition, the stable {100}<110> orientation was found to extend to {114}<110> or nearby orientation.

For the SUS329J1 ferrite/austenite duplex steel sheet, the initial ferrite possessed a strong {100}<110> and {110}<001> texture components. Since the pancake-like duplex morphology, the orientation splitting was confirmed at ε=5%. At about ε=15%, the weak {111}<110> component and {114}<110> and nearby orientation was confirmed. It suggested that the pancake or multilayered microstructure has a clear multiphase interlayer constraint to the grain rotation so that the interesting texture evolution takes place.