実験報告書様式（一般利用課題・成果公開利用）

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# MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2016A0308 実験課題名 Title of experiment Understanding of ductile deformation behavior of as-quenched martensite in the new generation-AHSS 実験責任者名 Name of principal investigator Mayumi Ojima 所属 Affiliation The University of Tokyo	装置責任者 Name of responsible person Harjo Stefanus 装置名 Name of Instrument/(BL No.) BL19 実施日 Date of Experiment 2016/11/22-26

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.

Chemical compositions of steels used in this beamtime are listed in the Table1. As listed in the approved proposal, various kinds of martensitic steel with different grade of carbon content and different Ms (Martensite-start-temperature) were tested. All martensitic steels listed here are sandwiched by high elongated steels. Sample #1～#3 includes conventional austenitic stainless steels (SUS316L) and sample #4 includes high-Mn steels as elongation steels.

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.

Tensile samples were prepared for each martensitic steels and scattered neutron was counted/monitored during deformation on the loading set-up as shown in Figure 1. Accumulation time of counted neutron is in this study for 900sec – 3600sec, which basically depends on the volume fraction of martensite. Tensile property of multilayered steel as applied in this study is affected by the ratio of volume fraction of constituent steels. Large elongation is obtained in all samples even they include hard/brittle martensite. Geometry of tensile test piece for the TAKUMI is nonstandard because of beam path. Comparison of the tensile results obtained by standard test piece (JIS13B) are also shown in Table2. In this study, dependence of the geometry of test piece was not confirmed.

Table 1 Chemical compositions of steel used. (in mass%)

		C	Si	Mn	Ni	Cr	Mo	Cu	Fe	Ms (℃)*Ref
#1	14Ni-Fe	0.002	0.25	0.25	14	–	–	–	bal.	300
#2	0.13C-Fe	0.13	0.25	0.9	0.02	0.83	0.34	0.19	bal.	430
#3	0.2C-14Ni-Fe	0.2	0.25	0.25	14	–	–	–	bal.	230
#4	0.4C-3Ni-Fe	0.4	1.55	1.8	2.96	1.5	0.19	–	bal.	250

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

Figure 2 shows the microstructure of martensitic layer applied by in this measurement. It is well known that lath martensite has hierarchal structure, that is prior austenite, packet, block/sub-block and lath. Obtained micrograph also shows the hierarchal structure. On the other hand, it is found that block/sub-block size decrease with decrease of carbon grade. Figure 3 shows the whole profile obtained by #2 sample, the monolithic martensitic steel and monolithic austenitic steel. Volume fraction of martensite is small in layered steel but obtained profile has enough intensity for prolife fitting. Full width at half maximum (FWHM) at the first peak of martensite obtained by Gaussian fitting was compared between samples with different carbon grade as shown in Figure 3. It is found that FWHM tends to increase with increasing of carbon grade. It is reported that dislocation density of martensite is affected by the strength of prior austenite, however, the correlation between strength of prior austenite affected by carbon grade and dislocation density of martensite is still not understood. Further discussion is required.

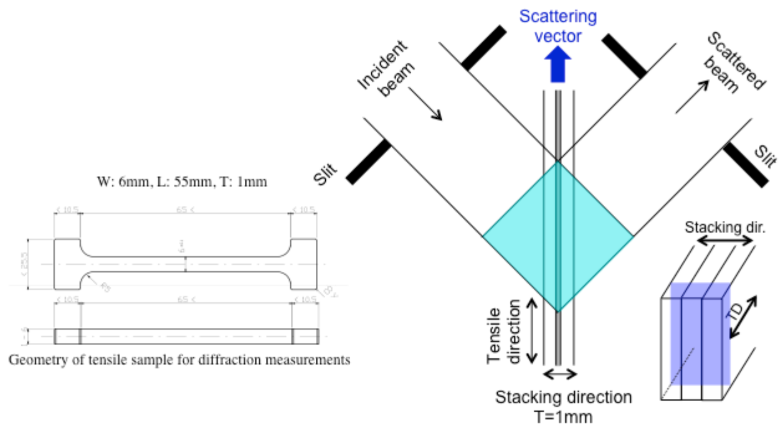

Figure 1 Schematic illustration of diffraction measurement in this beam time.

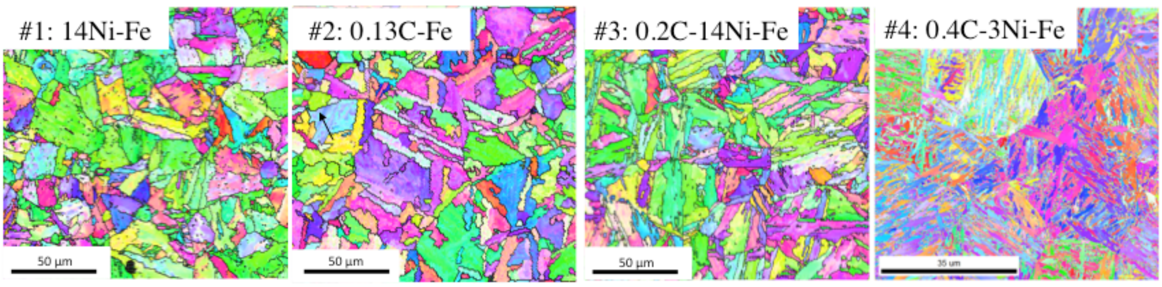

Figure 2 Microstructure of martensite for sample #1 – #4

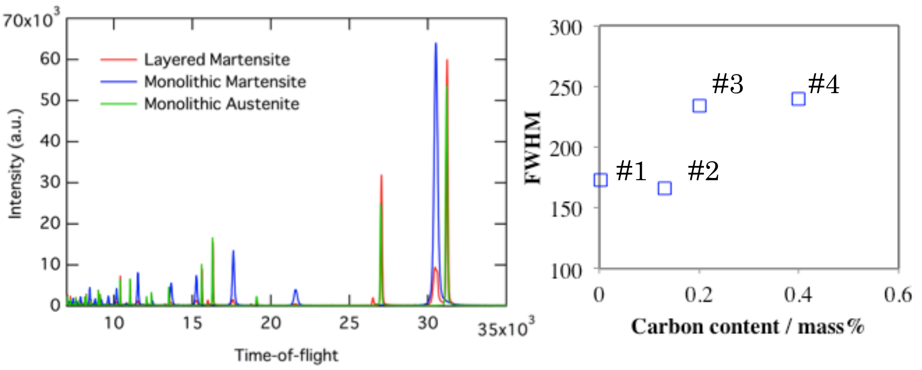

Figure 3 Profile in the wide range of TOF and FWHM of martensite for each sample.