Dislocation characteristics of martensitic steel studied by *in-situ* neutron diffraction experiment

T. Kawasaki[1#], S. Harjo[1], W. Gong[1], K. Aizawa[1], T. Iwahashi[1], Y. Tomota[2] and T. Ungár[3]

[1] *J-PARC Center, JAEA, Tokai, Ibaraki, Japan*
[2] *Graduate school of Science and Engineering, Ibaraki University, Hitachi, Ibaraki, Japan*
[3] *Department of Materials Physics, Eötvös University Budapest, Budapest, Hungary*
 # a corresponding author: E-mail takuro.kawasaki@j-parc.jp

The microstructure and the mechanical property of martensitic steels have been widely investigated [1]. To evaluate the characteristics of the microstructure of materials, such as dislocation density, dislocation character and crystalline size, is as important as elastic strain in order to understand the mechanical properties of the materials. These characteristics can be obtained by analyzing the peak profile in X-ray or neutron diffraction patterns. Although high-penetrability of neutron enables direct observation of the characteristics inside bulky materials, not much research on the microstructure which uses neutron diffraction, especially pulsed neutron, is available. On the other hand, the convolutional multiple whole profile fitting (CMWP) method [2] is a powerful tool for the analyses of diffraction patterns which have overlapping peaks or asymmetrical shaped peaks. In the present study, the dislocation characteristics of a martensitic steel (22SiMn2TiB) during tensile deformation was investigated by *in-situ* neutron diffraction experiment using Engineering Material Diffractometer TAKUMI at BL19 of MLF/J-PARC and CMWP method. The obtained dislocation density and the dislocation arrangement parameter of the martensite phase are plotted as a function of macroscopic strain in Figure 1. It is noted that small *M** means that there is strong correlation between dislocations. According as the strain increases, significant increasing of the correlation was observed though the increasing of dislocation density is not very much.

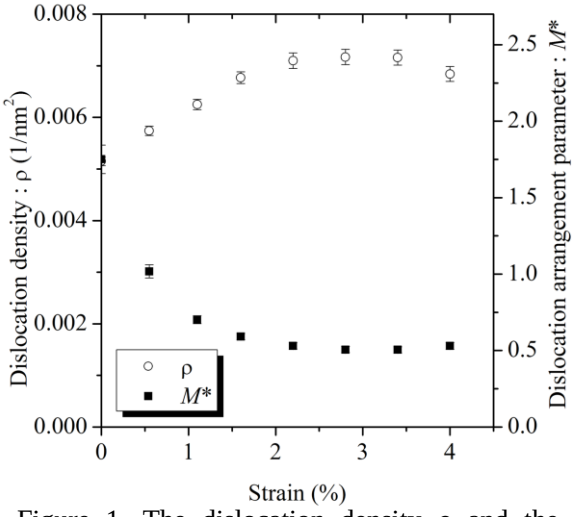

Figure 1. The dislocation density ρ and the dislocation arrangement parameter *M** of the martensite phase in 22SiMn2TiB steel.

References

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