

# *In-situ* neutron texture measurement of titanium sheets during high-temperature heat treatment

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## 1. Introduction

Titanium sheets usually show large anisotropy of mechanical properties due to its strong texture of  $\alpha$  (hcp) phase which is formed by one-directional cold rolling followed by recrystallization annealing. Transformation process of  $\beta$  (bcc) to  $\alpha$  phase has potential to reduce the intensity of the texture because 12 variants can generate in individual  $\beta$  grain during the transformation of  $\beta$  phase to  $\alpha$  phase. It was reported in previous research that memory effect of texture occurred [1], however it is still unclear behavior of texture development by transformation process. This study aims to investigate a mechanism of texture formation during transformation in titanium sheets. Thus, *in-situ* neutron measurement is conducted during heat treatment. In current work, we investigated appropriate measurement condition for titanium sheet.

## 2. Experiment

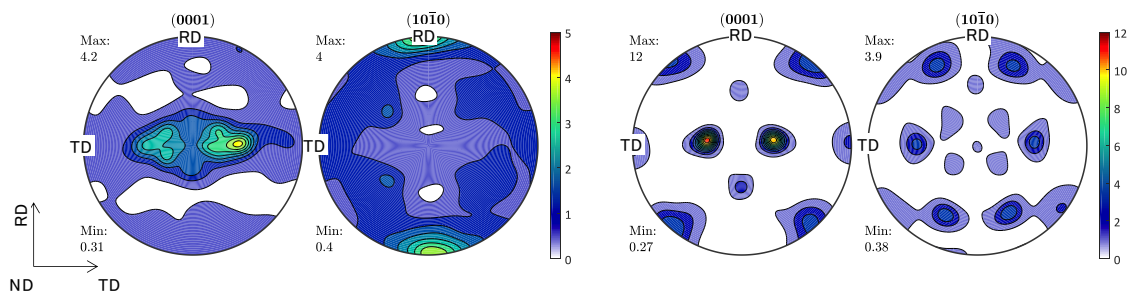
*In-situ* neutron diffraction experiments were conducted at the beam-line 20 'i-Materia' in J-PARC. Titanium sheets with 0.5mm in thickness were used. Several numbers of sheets were stacked and attached to a holder. The specimens were heated to temperature in  $\beta$ -single-phase and then kept for 60 min followed by cooling to room temperature.

## 3. Results

The titanium sheets distorted during heating process which caused problem of temperature control in many experimental trials. For one specimen, the whole heat-treatment process successfully proceeded. Figure 1 shows pole figures of hcp phase (a) before heating and (b) after heat treatment (at room temperature). Comparing both textures, it was found that the intensity of (0001) poles became stronger after heat treatment at around  $30^\circ$  tilted toward transverse direction (TD) from normal direction (ND), which suggested that memory effect occurred in this study. Intensity of neutron diffraction of bcc phase during high temperature heat treatment was relatively weak to analyze. It will be future work to construct more proper measurement condition.

## 4. Conclusions

- (1) Memory effect of texture occurred in the titanium sheets by heat treatment including transformation process.
- (2) We found that distortion of sheet had to be prevented to conduct appropriate measurement. We will try to modify experimental procedures in next work.



**Figure 1.** Pole figures of (0001) and (10-10) poles of titanium sheet.  
(a) Before heating, (b) After heat treatment (at room temperature).

## Reference

- [1] Lonardelli et al.: Acta Mater., 2007, vol.55, pp. 5718-5727.