In-field annealing effects on as-melted Mn-Al

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$L1_0$-MnAl (τ-phase) is one of the Mn-based ferromagnetic alloys with high uniaxial magnetic anisotropy. Because τ-phase is not the equilibrium state, appearance of the non-ferromagnetic equilibrium β and γ phases decreases the magnetization.

Ferromagnetic phase stabilizes under the magnetic fields due to the gain of Zeeman energy. In-field heat treatment for ferromagnetic alloys has been perfomend so far [1-2]. We previously reported in-field heat treatment for Mn-Al bulk sample, resulting in the improvement of magnetization. This is due to the ε–τ transformation was enhanced by magnetic fields. In this study, for further investigations for synthesis of τ-phase, the in-field annealing for as-melted Mn-Al alloys was performed under high magnetic fields up to15 T.

Mn-Al alloys were obtained by induction melting. Rod-shaped sample was cut into disks with 2 mm thick. In-field heat-treatments for as-melted samples were performed at 623 K in 0 T and 15 T. The phases in the alloy were characterized by X-ray diffraction (XRD) measurements. The magnetic properties was evaluated by the vibrating sample magnetometer.

Fig. 1 shows the XRD patterns of Mn-Al alloys for as-melted sample (a) and the sample annealed in 0 T (b) and that in 15 T (c). In 0 T, diffraction peaks of residual τ–phase and β-phase were detected. Compared to this, diffraction peaks of β-phase for the sample annealed in 15 T were smaller than that of 0 T. Thus, it was found that in-field heat treatment for τ-Mn-Al alloys suppressed the synthesis of paramagnetic β-phase.

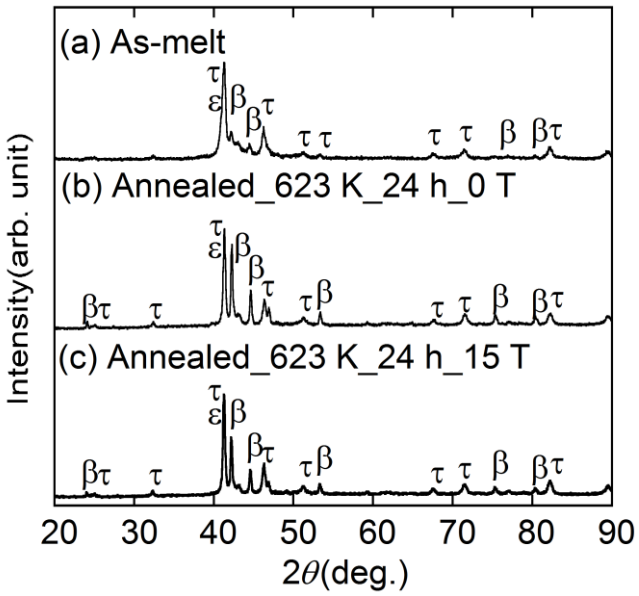

Fig.1. Bulk X-ray diffraction patterns of Mn-Al alloys.

References:
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