Aging precipitation structure observation of Mg-Zn alloys by HRTEM

Maeda, T.[1]

[1] Graduate School of Science and Engineering for Education, University of Toyama, Japan

General interest in Mg alloy is increasing due to its good mechanical properties as structural application. Zn addition can enhance room temperature strength by solid solution effect. Also Mg-Zn alloy can be strengthened by precipitation hardening by aging treatment using super saturated solid solution (S.S.S.S). Recent studies have revealed the structure and morphology of precipitates of Mg - Zn alloys, and the precipitation sequence of Mg-Zn alloy is suggested that like : S.S.S.S→G.P.zones→β_1'→ β_2'→ β. β_1' phase is considered as a reinforcing phase has a rod shape and parallel to the [0001] Mg direction of matrix. β_2' phase forms from β_1' and has plate shape on (0001) Mg plane of matrix. However, precipitation process, nucleation and growth process of precipitates are not completely known.

In this study, Mg-2.2at.%Zn alloy was prepared to observe the precipitation sequence. This alloy was prepared by gravity casting. Homogenization was carried out at 603 K for 43.2 ks, and the sample cut to a thickness of 3 mm was hot rolled to 1 mm. The solution treatment was performed at 603 K, 3.6 ks in an argon atmosphere and then quenched into water at 293 K. Aging treatment was conducted at 473K. TEM specimens were prepared by twin jet electrolytic polishing method using mechanical polishing to a thickness of 0.1 mm and then using a solution of nitric acid: methanol = 1: 3 cooled to 253 K. Microstructure observation was carried out using transmission electron microscope (TEM) Topcon EM-002B under accelerated voltage of 120kV. HRTEM simulation used Mac Tempas X the multi slice method. At the initial stage of aging of the Mg - 2.2 at.% Zn alloy, the structure observation and the HRTEM simulation were carried out, and the aging precipitation behavior of this alloy and the structure of the precipitate were investigated.