

Precipitate observation of Al-Mg-Si-Cu-Ag alloys by HRTEM and HAADF-STEM

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Al-Mg-Si system alloys have been used widely in industries as structural materials. It has been reported that the mechanical properties can be improved by Cu or Ag addition in Al-Mg₂Si alloys by solid solution hardening. Also, they affect the mechanical properties by changing the precipitation sequence and shape of precipitates during aging treatment. We already reported the effect of each Cu or Ag addition on microstructure, the change of precipitation sequence and crystal structure, as well as the improvement for the number density of the precipitates. The effect of Cu and Ag on the properties of Al-Mg₂Si alloy. Alloy with added Cu have Q' phase that is AlMgSiCu Quaternary phase, and with added Ag have β' phase include Ag. However, the precipitation sequence has not been investigated in detail. The aim of this work is to investigate the effect of Cu and Ag addition with fixed Cu/Ag rate of 1.0 on Al-1.0%Mg₂Si alloy for the aging behavior by means of hardness measurements and TEM observations. Three kinds of alloys are prepared by using casting to investigate the effect of Cu and Ag addition on precipitation behavior of Al-Mg-Si alloys. Base alloy is Al-1.0mass%Mg₂Si. The alloy added Cu and Ag alloy are base-0.18mol%Cu-0.18mol%Ag and base-0.35mol%Cu-0.35mol%Ag alloy. Result of hardness measurement shows that Cu and Ag added alloy has high hardness value than base alloy. In TEM observation, it was possible to observe needle-like precipitations and their cross-sectional planes. Needle-like precipitates have orientation relationship with matrix; parallel to the <001>Al direction. Also, HAADF-STEM images were analyzed to investigate precipitation sequence of Q' phase.