The Al-Mg-Ge alloy is one of the age-hardening aluminum alloy after solution heat treatment. It has been proposed that the age-precipitation behavior of Al-Mg-Ge alloy is different from that of Al-Mg-Si alloy according to our previous works about the microstructure on Al-Mg-Ge alloy over-aged at 523K\(^1\). There are a few reports about microstructure on Al-Mg-Ge alloys observed by TEM for different aging temperature. But the age-precipitation structure of Al-Mg-Ge alloy has not been became clear. In this work, Al-Mg-Ge alloys observed age-precipitates were analyzed about their types of crystal lattice by HRTEM to understand the age-precipitation.

The alloy of Al-1.0mass%Mg\(_2\)Ge was obtained by laboratory casting. This alloy sheet with 1.5mm thickness and 15mm width was made by hot extrusion. The specimens were solution heat treated at 873K for 3.6ks in an air furnace, quenched in chilled water. Aging treatment was done in oil bath at 473K. After the aging, specimens are polished by using two type electrolyte, perchloric acid: ethanol=1:9, nitric acid: methanol=1:3 and make specimens for TEM. The microstructure was observed using TOPCON EM-002B operated at 120kV.

Figure 1 shows HRTEM images obtained for Al-1.0mass%Mg\(_2\)Ge alloy aged at 473K for 600ks. The hexagonal network of the bright dots in this cross section of precipitate was observed with the spacing about 0.72nm. It is recognized as the b'-phase in Al-Mg-Ge alloy.

Figure 2 shows HRTEM images obtained for Al-1.0mass%Mg\(_2\)Ge alloy aged at 473K for 600ks. The large precipitate is identified as the type-A precipitate in this alloy. It shows a rectangle network of 0.36nm and 0.69nm. This large precipitate are similar to the A-type precipitate in the Al-Mg-Si alloy with excess Si. It is found that the age-precipitates are b'phase and type-A precipitate in Al-1.0mass%Mg\(_2\)Ge alloy over aged at 473K for 600ks.

References
Fig. 1: HRTEM images of obtained for samples aged for 600ks: $b'$ phase.

Fig. 2: HRTEM images of obtained for samples aged for 600ks: Type-A precipitate.