

A Study on the Effect of Mg and Ag Additions and Age Hardening Treatment on the Properties of As-Cast Al-Cu-Mg-Ag Alloys

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Abstract : This study focuses on the effect of the addition of magnesium (Mg) and silver (Ag) on the mechanical properties of aluminum based alloys. The alloying elements will be added at different levels using the factorial design of experiments of $2^{2 \times 2}$; the two factors are Mg and Ag at two levels of concentration. The superior mechanical properties of the produced Al-Cu-Mg-Ag alloys after aging will be resulted from a unique type of precipitation named as ω -phase. The formed precipitate enhanced the tensile strength and thermal stability. This paper further investigated the microstructure and mechanical properties of as cast Al-Cu-Mg-Ag alloys after being complete homogenized treatment at 520 °C for 8 hours followed by isothermally age hardening process at 190 °C for different periods of time. The homogenization at 520 °C for 8 hours was selected based on homogenization study at various temperatures and times. The alloys' microstructures were studied by using optical microscopy (OM). In addition to that, the fracture surface investigation was performed using a scanning electronic microscope (SEM). Studying the microstructure of aged Al-Cu-Mg-Ag alloys reveal that the grains are equiaxed with an average grain size of about 50 μm . A detailed fractography study for fractured surface of the aged alloys exhibited a mixed fracture whereby the random fracture suggested crack propagation along the grain boundaries while the dimples indicated that the fracture was ductile. The present result has shown that alloy 5 has the highest hardness values and the best mechanical behaviors.

Keywords : precipitation hardening, aluminum alloys, aging, design of experiments, analysis of variance, heat treatments

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