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The Function of Cu Concentration in the Micro Structures of A Highly Alloyed Al-Zn-Mg-Cu Alloy

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Opinion

OM, SEM, TEM, tensile tests, XRD, and DSC were used to investigate the effect of Cu content on the microstructures and mechanical characteristics of a highly alloyed Al-10.0Zn-2.6Mg-xCu-0.15Zr alloy with Cu percentage ranging from 0 to 3.0 [1]. The Mg (Zn, Al, Cu) $_2$ () and $Al_2Mg_3Zn_3$ (T) phases were discovered in all as-cast alloys, whereas the Al_2Cu () phase was detected in alloys with Cu greater than 2.5 wt. %. It was also discovered that when Cu rose, the volume percentage of the primary phase increased. Furthermore, the volume fraction of the residual eutectic phase (REP) grew progressively with increasing Cu after solid solution, owing to Cu's poor diffusion coefficient, which prevented the second phase from dissolving [2]. Tensile tests of the aged alloys revealed that when Cu concentration is less than 1.0 wt. %, the strength of the alloys increases dramatically, however as Cu level increases, the strength diminishes. At low Cu concentration, the elongation rapidly increases to a maximal value. A minor drop occurs after reaching a threshold Cu level (1.5 wt %). The coupling impact of grain refinement and REP should be considered while elongating highly alloyed Al-Zn-Mg-Cu alloy [3]. Cu's influence on the microstructure and characteristics of the Al-Zn-Mg-Cu alloy has been researched before, with some promising results. For example, in alloys with constant Zn + Mg of 9.5, 10.0, 10.5, and 11.0, the precipitates rise with Cu content, resulting in increased tensile and yield strength; also, the recrystallization degree follows a similar pattern with strength .However, Dong discovered that when the Cu variation range is 0.8–2.2 wt. percent, the tensile strength of the Al-9.3Zn-2.4 Mg-x Cu alloy is inversely associated with the Cu, since the REP increases and precipitates decreases as Cu increases.he tensile strength of Al-6.7Mg-2.25 Mg-x Cu alloys is not affected by changes in Cu in the range of 1.5–2.5 wt. percent, according to Wanger, but the elongation drops dramatically as Cu increases owing to the rise of S phase. As previously stated, the results of the influence of Cu on the mechanical characteristics of Al-Zn-Mg-Cu alloys in the literature are plainly inconsistent. The discrepancy stems from the fact that the effects of Cu on the type and distribution of the second phase, as well as the recrystallization behaviour of alloys of various compositions, varies. There are few Al-Zn-Mg-Cu alloys that are highly alloyed, especially when the alloy composition is close to the limit solid solubility. As a result, the goal of this research is to investigate the impact of Cu addition on the microstructure and mechanical characteristics of a highly alloyed Al-10.0Zn-2.6 Mg-xCu-0.15Zr alloy on a wide scale (0–3 wt%) [4]. The findings will aid in understanding the impact of Cu on the microstructure, mechanical characteristics, phase composition, and evolution of highly alloyed Al-Zn-Mg-Cu alloys, as well as guiding the creation of novel alloys. The microstructure development and mechanical characteristics of a heavily alloyed Al-10.0Zn-2.6 Mg-xCu-0.15Zr alloy were investigated in this study. The following are some of the most important findings:

The key stages of as- are the and T phases. Cast Hard dissoluble phases are obtained in Al-10.0Zn-2.6 Mg-xCu-0.15Zr alloys with Cu higher than or equal to 2.5 wt. percent. Furthermore, when Cu increases, the main phase tends to increase. In Al-10.0Zn-2.6 Mg-xCu-0.15Zr alloy, the volume fraction of REP gradually increases with Cu increasing after solid solution due to the dissolution of the second phase is suppressed by the low diffusion coefficient of Cu [5].The strength of the Al-10.0Zn-2.6 Mg-xCu-0.15Zr alloy grows when Cu increases in the T6 state. When Cu is more than 1.0 wt. percent, however, the strength diminishes as Cu increases owing to a reduction in the volume fraction of precipitates. The elongation increases quickly with Cu at the early stage, after 1.5 wt. Cu content, a slight drop is followed. The fracture mechanism of Cu-free alloy is intergranular fracture. With the addition of Cu, the trend of recrystallization is improved, and the fracture mechanism gradually changes to dimple fracture.

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