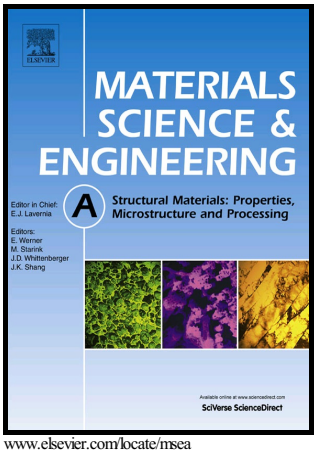
Effects of high Zn content on the microstructure and mechanical properties of Al–Zn–Cu gravity-cast alloys

Sang-Soo Shin, Kyung-Mook Lim, Ik-Min Park



www.elsevier.com/locate/msea

PII: S0921-5093(16)31086-3
DOI: http://dx.doi.org/10.1016/j.msea.2016.09.022
Reference: MSA34107

To appear in: *Materials Science & Engineering A*

Received date: 28 June 2016
Revised date: 3 September 2016
Accepted date: 3 September 2016

Cite this article as: Sang-Soo Shin, Kyung-Mook Lim and Ik-Min Park, Effect of high Zn content on the microstructure and mechanical properties of Al–Zn–Cu gravity-cast alloys, *Materials Science & Engineering A* http://dx.doi.org/10.1016/j.msea.2016.09.022

Effects of high Zn content on the microstructure and mechanical properties of Al–Zn–Cu gravity-cast alloys

Sang-Soo Shin[a], Kyung-Mook Lim[b*], Ik-Min Park[a*]

[a]*Department of Materials Science and Engineering, Pusan National University, Busan, 46241, Korea*

[b]*Korea Institute of Rare Metal, Korea Institute of Industrial Technology, Incheon, 21999, Korea*

mook@kitech.re.kr

impark@pusan.ac.kr

[*]Corresponding author. Doctor Kyoung-Mook Lim. Tel.: +82 32 458 5113; fax: +82 32 458 5120

[*]Corresponding author. Professor Ik-Min Pakr. Tel.: +82 51 510 2393; fax: +82 51 514 4457

Abstract

In this paper, the effects of Zn on the microstructural evolution, hardness, and various characteristics of Al–20~45Zn–3Cu alloys were investigated. High-strength Al–Zn–Cu alloys (> 450 MPa) were fabricated by gravity casting without melt modification or heat treatment (i.e. T4~T6). Al-based alloys containing more than 20% Zn were designed for the gravity-casting process. In terms of the microstructure, as the amount of Zn addition in the alloys increased, the α-phase size decreased and the α + η non-equilibrium solidification-phase fraction increased. A complex network of eutectoid α + η, supersaturated η, and Cu-related intermetallic particles formed in the grain boundary regions. In addition, increasing the Zn content improved the mechanical properties of the alloys but reduced their damping capacity and toughness. The fractographic examination of the fracture surfaces indicated that the Al-Zn-Cu alloys with high Zn addition had fewer ductile dimple surfaces and more brittle cleavage surfaces.

Keywords: Al–Zn–Cu alloys; Gravity casting; High strength; Damping capacity; Impact test

1. Introduction

Recently, the number of aluminum automobile components and electronic devices produced by the die-casting method has increased and now accounts for approximately 35% of the total production of aluminum parts. This increasing number of Al-cast alloys has been used for automotive parts, such as transmission cases, converter housings, and cylinder blocks. Furthermore, aluminum part production is expected to increase further due to the high-pressure die-casting (HPDC) process, as the HPDC method is more suitable for mass production due to its higher productive efficiency, and its capacity to produce near net shapes that are thin-walled with complex aluminum components,