Author's Accepted Manuscript

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 PII:
 S0921-5093(15)30590-6

 DOI:
 http://dx.doi.org/10.1016/j.msea.2015.10.127

 Reference:
 MSA32978

To appear in: Materials Science & Engineering A

Received date:18 July 2015Revised date:30 October 2015Accepted date:31 October 2015

Cite this article as: Peng Zhang, Zhenming Li, Baoliang Liu, Wenjiang Ding and Liming Peng, Improved tensile properties of a new aluminum alloy for hig pressure die casting, *Materials Science & Engineering A* http://dx.doi.org/10.1016/j.msea.2015.10.127

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Improved tensile properties of a new aluminum for high pressure die

casting

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Abstract

This paper investigates the effects of strain rate and test temperature on the tensile properties and deformation behavior of a recently developed high-ductility cast aluminum alloy Al-5Mg-0.6Mn. The as-cast alloy tested at room temperature and the lowest strain rate of $\sim 1.67 \times 10^{-4} \text{ s}^{-1}$ shows the highest yield strength of ~ 212 MPa, ultimate tensile strength of ~ 357 MPa and elongation ($\sim 17.6\%$). Increasing strain rate reduces the ultimate tensile strength and ductility of the as-cast alloy. With the increasing of test temperature, the as-cast alloy shows significantly decreases in tensile strengths and improvements in elongation. The tensile failure of the alloy is mainly originated from the cracking and debonding eutectic particles. The Portevin-Le Chatelier effect occurs in the alloy tested at RT. Strain rate in current study ranges does not significantly affect the work-hardening behavior of the alloy. Increasing test temperature apparently reduces the strain-hardening exponent and coefficient. For the alloy tested at RT, all tensile failures occur prior to global instability, indicating the existence of localized damage. In contrast, for the alloy tested at HT, the global instability occurs at strains below the logarithmic fracture strains, suggesting that there is still a postnecking damage. Keywords: Al-5Mg-0.6Mn aluminum alloy; high pressure die casting; tensile properties; strain rate; high temperature

1. Introduction

Die cast aluminum alloy are increasingly used in automotive, aerospace and other transportation industries for light weighting and better performance ^[1-4]. Among various kinds of casting process,

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