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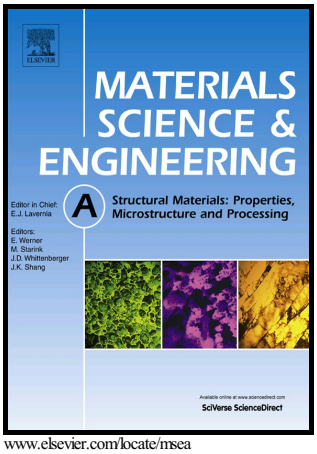

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Improved tensile properties of a new aluminum for high pressure die casting

Peng Zhang[1], Zhenming Li[1*], Baoliang Liu[2], Wenjiang Ding[1], Liming Peng[1]

[1]National Engineering Research Center of Light Alloys Net Forming and State Key Laboratory of Metal Matrix Composite, Shanghai Jiao Tong University, Shanghai, 200030, P. R. China

[2] National Engineering Research Center of Light Alloys Net Forming Feng yang branch center, Chuzhou, 233100, P. R. China

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 ~1.67×10^{-4} s^{-1} shows the highest yield strength of ~212 MPa, ultimate tensile strength of ~357 MPa and elongation (~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,

* Corresponding author. Tel.: +86 021 54742618; fax: +86 021 34202794.
E-mail address: lizhenming516@163.com (Z.M. Li)