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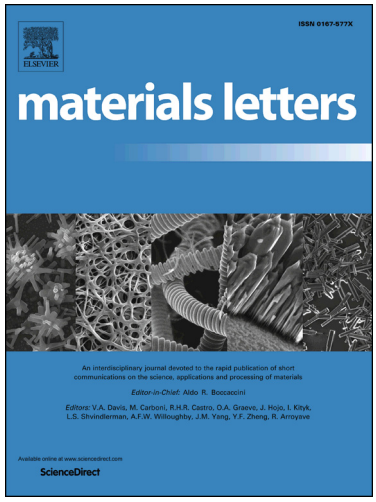

Microstructure, mechanical properties and corrosion behavior of Rheo-HPDC a novel Al-8Si-Fe alloy

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Microstructure, mechanical properties and corrosion behavior of Rheo-HPDC a novel Al-8Si-Fe alloy

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ABSTRACT

Microstructure, mechanical properties and corrosion behavior of a novel Al-8Si-Fe alloy fabricated by Rheo-HPDC were investigated. Compared with the HPDC alloy, the microstructure (α_1/α_2-Al, Si and β-Al_5FeSi phases) of the alloy was greatly refined by Rheo-HPDC. The Rheo-HPDC alloy showed improved mechanical properties and thermal conductivity to those prepared by HPDC, and the increasing rates of UTS, YS, elongation, hardness and thermal conductivity were 31%, 19%, 59%, 12% and 10%, respectively. Rheo-HPDC Al-8Si-Fe alloy also indicated a significant improvement in corrosion resistance as demonstrated by the results of immersion, electrochemical and scanning kelvin probe (SCP) tests.

Keywords: Al-8Si-Fe, Rheo-HPDC, Microstructure, Mechanical properties, Thermal conductivity, Corrosion

1. Introduction

Hypoeutectic Al-Si-Fe alloys are widely used in automotive and communication fields due to their good elevated temperature thermal stability [1-3]. Iron is considered to be an impurity in Al-Si alloys, which is easy to precipitate as the β-Al_5FeSi phase [3,4]. However, the AlFeSi phase tends to show needle-like, resulting in a decrease of mechanical properties of Al-Si-Fe alloys [3-5].

High pressure die-casting (HPDC) is always an efficient and economical process for preparing hypoeutectic Al-Si-Fe alloy parts. However, HPDC parts contain many porosities and coarse β-Al_5FeSi [6,7], which limit their wider applications in relevant areas. In recent years, as an effective process to improve microstructure and properties of aluminum alloys, Rheo-HPDC has acquired increasing attention [6,8]. The process can refine the grain of aluminum alloys and decrease volume fraction of second phase [8-10]. The second phase affects corrosion behavior of aluminum alloys [11,12]. Thus, it is feasible to improve corrosion resistance by altering the volume fraction and morphology of second phase. What's more, to the best of our knowledge, the effect of Rheo-HPDC on corrosion behavior of aluminum alloys has not been studied. Thus, in this work, effects of Rheo-HPDC on the microstructure, mechanical properties and corrosion behavior of a newly-developed Al-8Si-Fe alloy were investigated.