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Materials Today: Proceedings 15 (2019) 126–131

materialstoday: PROCEEDINGS

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FCCM-2018

Effect of Nd on the microstructure and corrosion behaviour of Mg-9Li-3Al magnesium alloy in 3.5 wt.% NaCl solution

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Abstract

As-cast Mg-9Li-3Al-xNd (x = 0-2.0 wt.%, with the variation of 0.5wt.%) magnesium alloys were prepared through casting in electrical induction melting furnace under a controlled inert gas atmosphere. Influences of Nd over the metallography changes and corrosion characteristics of Mg-9Li-3Al alloys have been examined by following techniques are OM, XRD, SEM and potentio-dynamic polarization (PDP) test. The results illustrate that adding Nd modifies the continuous β-Li phases into discontinuous phase by the formation of new precipitates such as Al_2Nd and $Al_{11}Nd_3$. Meanwhile, the grain sizes of Mg-9Li-3Al-xNd alloys reduced with respect to the increasing Nd content. PDP results disclose that the Nd addition reduces the corrosion current density (i_{corr}) of Mg-9Li-3Al alloys which can be essentially produced by grain refinement.

Selection and peer-review under responsibility of Frontiers in Corrosion Control of Materials, FCCM-2018.

Keywords: rare earth; corrosion behavior; polarization

1. Introduction

In recent decades, magnesium alloys have been attracted by the researchers as well as aerospace, military and 3C industries due to increasing demand for lightweight structural components. Magnesium alloys exhibit impressive following characteristics; low density, good ductility, castability, good specific strength, magnificent machinability at high speed, excellent damping capacity, high specific stiffness, strong electromagnetic shielding property [1-4]. Nevertheless, the formability of Mg alloy is insignificant because of the HCP crystal structure of magnesium [5]. To avoid this shortcoming, addition of lithium with density of 0.534g/cm^3 has been introduced to Mg alloys. Therefore, adding lithium heads to further reduction in the density of alloys from 1.74 g/cm^3 to 1.4-1.65 g/cm^3.

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Selection and peer-review under responsibility of Frontiers in Corrosion Control of Materials, FCCM-2018.