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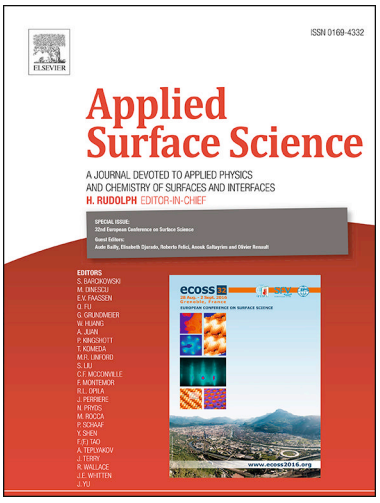

Full Length Article

An Environment-Friendly Phosphate Chemical Conversion Coating on Novel Mg-9Li-7Al-1Sn and Mg-9Li-5Al-3Sn-1Zn Alloys with Remarkable Corrosion Protection

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An Environment-Friendly Phosphate Chemical Conversion Coating on Novel Mg-9Li-7Al-1Sn and Mg-9Li-5Al-3Sn-1Zn Alloys with Remarkable Corrosion Protection

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Abstract:

An environment-friendly phosphate chemical conversion (PCC) coating has been deposited on novel LAT971 (Mg-9wt%Li-7wt%Al-1wt%Sn) and LATZ9531 (Mg-9wt%Li-5wt%Al-3wt%Sn-1wt%Zn) alloys for improving their corrosion resistance. A dense and homogeneous flower like morphology (~ 30µm thick) was observed on the PCC coated Mg-Li based alloys. The presence of calcium hydrogen phosphate hydrate, tricalcium phosphate and trimagnesium phosphate were confirmed from the X-ray diffraction and X-ray photoelectron spectroscopy analysis. A lower corrosion current density of 6.74×10^{-7} mA/cm^2 and 5.39×10^{-7} mA/cm^2 was obtained for PCC coated alloys in 3.5 % NaCl aqueous solution than that of uncoated LAT971 (0.82 mA/cm^2) and LATZ9531 (0.34 mA/cm^2) alloys, respectively, which offers corrosion protection efficiency of > 99%. Electrochemical impedance spectroscopy (EIS) has revealed that the inner PCC coating (at coating/substrate interface) delay the direct contact between electrolyte and substrate, which offered higher charge transfer resistance (> 4 orders of magnitude) than that of uncoated alloys. Thus, the PCC coating provides an effective corrosion protection to the ultra-lightweight LAT971 and LATZ9531 alloys surface and may be helpful in proving good anchoring with the top organic coatings or paints.

Keywords: Mg-Li alloys (LAT971, LATZ9531); Corrosion resistance; Chemical conversion coating; Corrosion current density; Charge transfer resistance.

1. Introduction

Magnesium and its alloys are recognized as one of the lightest structural materials for automotive and 3C electronics (computer, communication, and consumer) industries because of its low density, high specific strength, good thermal conduction, and electromagnetic wave shielding capacity [1–3]. However, its poor formability at room temperature restricts its applications due to its

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