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Composition and microstructure dependent corrosion behaviour of Mg-Li alloys

C.Q. Li[a,b,c], D.K. Xu[b,*], X.-B. Chen[a,d], B.J. Wang[e], R.Z. Wu[f], E.H. Han[b,c], N. Birbilis[a,*]

[a] Key Laboratory of Nuclear Materials and Safety Assessment, Institute of Metal Research, Chinese Academy of Sciences, Shenyang 110016, China
[b] Department of Materials Science and Engineering, Monash University, Clayton, VIC 3800, Australia
[c] Key Laboratory for Anisotropy and Texture of Materials (Ministry of Education), Northeastern University, Shenyang 110819, China
[d] School of Engineering, RMIT University, Carlton, VIC 3053, Australia
[e] School of Environmental and Chemical Engineering, Shenyang Ligong University, Shenyang 110159, China
[f] Key Laboratory of Superlight Materials & Surface Technology, Ministry of Education, Harbin Engineering University, Harbin, 150001, China

*Corresponding author Daokui Xu, Email: dkxu@imr.ac.cn and Birbilis Nick, Email: birbilis.nick@monash.edu

Abstract: The corrosion and electrochemical behaviour of carefully prepared ultra-lightweight magnesium-lithium (Mg-Li) alloys were investigated and compared. The alloy compositions studied were selected to provide the ability to compare unique microstructures and crystal structures, which arise from specific alloying additions of Li. Mg-4%Li is hexagonal closed-packed (HCP) alloy with Li in solid solution of Mg (α-Mg); Mg-14%Li is a fully solid solution BCC (β-Li) alloy, whilst Mg-7.5%Li is a duplex (α-Mg + β-Li) alloy. Testing in 0.1 M NaCl revealed that the corrosion performance and electrochemical response of the Mg-Li system evolved with the composition and crystallographic structure. For Mg-4%Li alloy, filiform-like corrosion morphology can be observed on the corroded surface, whilst a mixture of filiform-like corrosion to the α-Mg and localised dissolution of β-Li existed on the corroded surface of Mg-7.5%Li alloy. In the case of the BCC structured Mg-14%Li alloy, minor pitting was observed, concomitant with a generally low corrosion rate (particularly low corrosion rate for typical Mg alloys) and an increasing corrosion resistance