



Fundamentals and advances in magnesium alloy corrosion



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ABSTRACT

There remains growing interest in magnesium (Mg) and its alloys, as they are the lightest structural metallic materials. Mg alloys have the potential to enable design of lighter engineered systems, including positive implications for reduced energy consumption. Furthermore, Mg alloys are also emerging as viable biodegradable materials and battery electrodes. In spite of the greatest historical Mg usage at present, the wider use of Mg alloys remains restricted by a number of inherent limitations, including vulnerability to corrosion, poor formability and low creep resistance. This review covers recent research that has led to advances in Mg-alloy corrosion; including the application of contemporary methods for understanding Mg corrosion, the establishment of an electrochemical framework for Mg corrosion, illumination of alloying effects, and attempts at corrosion resistant Mg alloys. A discussion drawing from many sources provides an unbiased focus on new achievements, as well as some contentious issues in the field. The electrochemistry of Mg is reviewed in detail, including so-called anodic hydrogen evolution and cathodic activation. This review also covers atmospheric corrosion, and biodegradable Mg alloys. Finally, past and present trends in the field of Mg corrosion are reviewed, identifying knowledge gaps, whilst attempting to also identify future developments and directions.

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