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Development of New Wrought Mg Alloys: Improving the Corrosion Resistance by Addition of Alloying Elements

G. Ben Hamu

Department of Mechanical Engineering, Sami Shamoon College of Engineering,
Ashdod 77245, Israel.

Magnesium (Mg) alloys constitute an attractive structural materials for transportation industries, due to their low density and high strength/weight ratio. However, high susceptibility to corrosion of Mg alloys limits their use. Therefore, there is a growing interest for development of new Mg alloys with good mechanical properties and superior corrosion resistance. Production of wrought Mg alloys results in enhancement of mechanical properties, whereas addition of alloying elements may result in improved corrosion behavior.

In this study we distinguish the role of different additions on the corrosion performance of new wrought magnesium-aluminum and Mg-Zn alloys. The corrosion behavior was tested in short and long immersion periods. Overall, addition of alloying elements resulted in precipitation of second phase particles with cathodic behavior (relatively to Mg matrix). This enhanced the micro-galvanic effects and the corrosion resistance in short periods of immersion was deteriorated. However, in long periods of immersion the passive characteristics of the oxide layer played a significant role in improving the alloys' corrosion resistance. The contribution of each element to the oxide layer will be discussed. In general, the quantities of alloying element should be sufficient to stabilize the corrosion products layer; yet as low as possible, in order to reduce the micro-galvanic effects.