Sono-immersion Deposition on Magnesium Alloy: Sonication Effect on the Coating Process

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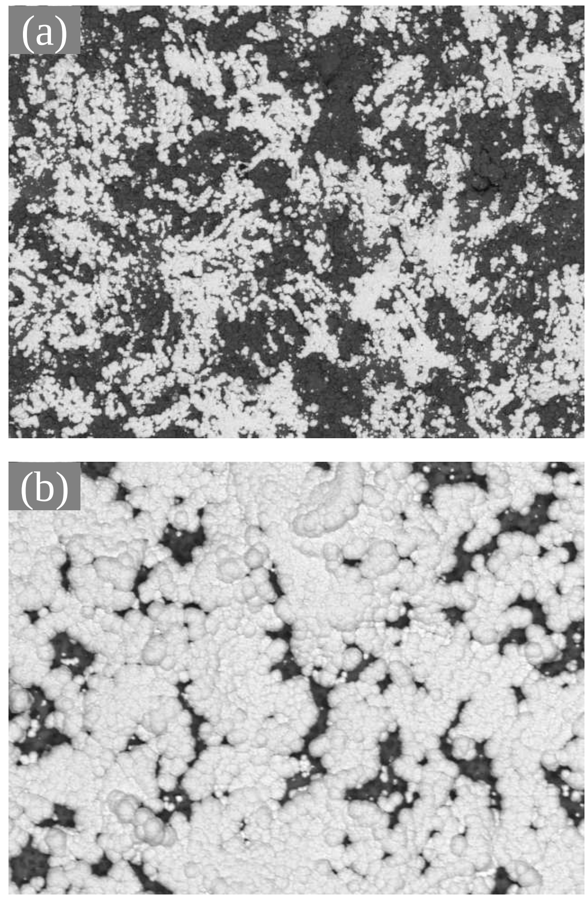
Abstract Magnesium is the lightest structural metal with the highest specific strength. It is therefore regarded as a solution for mass reduction of vehicles such as automobile and aircraft. To improve its corrosion resistance it is viable to apply a desirable engineering coating on the magnesium surface. It was suggested[1] that magnesium alloy can be electroless/eletro-plated; but satisfactory process sequences have yet to be developed to meet various industrial requirements.

Magnesium is generally known as a difficult to plate metal due to its high reactivity. Special procedure is therefore required to obtain an adherent and corrosion-resistant coating. This procedure includes a chemical etching step to remove the oxide film on the magnesium surface, an immersion coating process as an under layer for the subsequent coatings and finally an eletroless/electrodeposition process[2]. While every step in the procedure is critical, the immersion coating process is the most important. Our recent research therefore focused on a simple copper immersion coating on the AZ91 alloy in the presence of sonication.

During the copper immersion coating EIS was conducted and open circuit potential was monitored. Surface morphologies of the obtained coatings were examined by scanning electron microscopy. The Figures (a) and (b) presented clearly indicates that the application of sonication significantly increased the copper surface coverage. A complete analysis of the experimental results indicated that, during the immersion coating, formation of surface film on the uncoated magnesium area under silent condition restrained magnesium dissolution and slowed down the coating process. The application of sonication, however, induced asymmetric cavitations at the interface and efficiently deconstructed or prevented the formation of surface film. As a result, the anodic reaction (magnesium dissolution) could be maintained to provide a continuous driving force for the cathodic reduction of copper deposition, hence increasing the surface coverage.



Back-scattered electron images for the magnesium alloy after the copper immersion coating in 3.3M HF + 0.67M $CuSO_4$ containing electrolytes: (a) still bath and (b) sonicated bath.

Reference:

1. Gray J.E., and Luan B., J. of Alloys and compounds 336 88 (2002)
2. ASTM Standard, B 480 – 88, (1988).

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