

Preparation and Properties of Micro-arc Oxidation Composite Self-healing Coating on Magnesium Alloy

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Abstract Magnesium alloy will quickly occur filiform corrosion, when the coating is broken. Self-healing coating can be to a certain extent to extend the protective time of the coating. But it is difficult to realize a single coating on the magnesium alloy of long-lasting protection, because magnesium alloy substrate of the filiform corrosion will lead to the stripping failure of the coating. In this paper, micro-arc oxidation composite self-healing coating was prepared on the surface of AZ31B magnesium alloy by combining micro-arc oxidation technology with micro-capsule self-healing coating. The effects of frequency, duty cycle and current density on the energy consumption of the micro-arc oxidation process and the performance of the film layer in the constant-current mode were investigated. The process conditions of micro-arc oxidation with lowest power consumption and best corrosion resistance were determined. Microcapsules with self-healing effect were prepared by in-situ polymerization, then were doped into the epoxy resin as self-healing coating. The corrosion resistance of the self-healing coating increases and then decreases with the increase of the microcapsule content in the coating. When the microcapsule content is 10%, the self-healing coating has the best corrosion resistance, at which time the coating resistance is $1.03 \times 10^5 \Omega\text{cm}^2$ and the salt spray resistance time is the longest. There is no obvious corrosion phenomenon on the sample of the self-healing coating after 1000 h salt spray. Micro-arc oxidation composite self-healing coating corrosion resistance is significantly better than a single self-healing coating, micro-arc oxidation film as the bottom layer can change the corrosion mechanism at the interface of magnesium alloy, effectively inhibit the coating stripping phenomenon caused by the filamentary corrosion of magnesium alloy, slowing down the corrosion expansion. It will significantly extend the service life of the coating, and realize the long-lasting protection of magnesium alloy.

Keywords Magnesium alloy, Micro-arc oxidation, Self-healing, Composite coating