IMPROVED CORROSION RESISTANCE OF AZ91D Mg ALLOY BY CERIUM-BASED FILMS. FORMATION OF A DUPLEX COATING WITH POLYPYRROLE

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In order to improve the corrosion resistance of die-cast AZ91D magnesium alloy in simulated physiological solution, two cerium-based coatings were synthesized. The coatings were electrodeposited from solutions containing $Ce(NO_3)_3$, H_2O_2 and $C_6H_8O_7$ or $C_4H_4O_6Na_2$. The influence of the presence of sodium tartrate and citric acid in the preparation solution on the morphology, composition and anticorrosive performance of the generated coatings was evaluated. The corrosion properties were examined in Ringer solution by polarization studies, open circuit measurements and faradaic impedance spectroscopy. Results showed that the incorporation of additives improves the anticorrosive properties of the films formed without sodium tartrate or citric acid. The coating formed in the presence of sodium tartrate showed the best anticorrosive performance. Subsequently, the possibility of forming duplex coatings employing the cerium-based films as inner layers and polypyrrole as top coating was evaluated. At this point, it was found that polypyrrole can be electropolymerized on top of the formed cerium-based film modified with sodium tartrate.

Keywords: AZ91D Mg alloy, cerium-based coating, citric acid, sodium tartrate, polypyrrole, anticorrosive properties

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CONCLUSIONS

Two coatings were obtained on AZ91D Mg alloy in solutions containing $Ce(NO_3)_3$, H_2O_2 and NaTar or H_3Cit. The films present the typical mud-cracked morphology of cerium coatings. Under the employed working conditions, NaTar acts as a corrosion inhibitor while H_3Cit forms soluble chelates that promote the dissolution of the alloy. The addition of NaTar to the electrolyte solution leads to the formation of a coating that retards the alloy dissolution in a higher degree than cerium coatings formed in the absence of NaTar. Electropolymerization of PPy was carried out on the alloy surface previously covered with an RCe–Tar coating formed during 60 s. The anticorrosive performance of the duplex coating is slightly worse than the corresponding to RCe–Tar. However, the morphology of the polymeric film is characterized by the presence of microtubes and spherical structures which are very interesting for biomedical applications as drug delivery or species immobilization.

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