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Structure and properties of newly designed MAO/TiN coating on AZ31B Mg alloy

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Abstract: A duplex MAO/TiN coating was fabricated on AZ31B Mg alloy through micro-arc oxidation (MAO) followed by a multi-arc ion plating (M-AIP) process. The structure, composition, and corrosion resistance of these coated samples were evaluated using SEM, EDS, XRD, and electrochemical methods. The results showed that the porous MAO layer was effectively sealed by the M-AIP layer, indicating that the MAO layer can act as an interlayer to offer an inert rough surface and necessary hardness for the Mg alloy to bond with the M-AIP layer (especially for a hard coating such as TiN). The MAO/Ti-coated samples exhibited the worst corrosion resistance and lower hardness compared with the MAO-coated samples, while the MAO/TiN coating provided higher corrosion resistance and hardness. It can be speculated that unavoidable defects such as pores and cracks are responsible for the poor properties. Although the MAO layer was demonstrated to improve the interfacial compatibility between the hard coating and the soft substrate, a compact and dense hard coating is still essential to ensure the corrosion and wear resistance of Mg alloys.

Keywords: Magnesium alloy; Coatings; Micro-arc oxidation; Multi-arc ion plating; TiN