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Electrophoretic deposition of Nano-Zirconia coating on AZ91D magnesium alloy for bio-corrosion control purposes

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Abstract

Magnesium alloys are considered as potential biodegradable biomaterials in hard tissue implants. However, the fast degradation rate of these alloys in the biological environment causes failure of the implant just prior to the desirable time. In the present work, in order to decrease and curb the bio-corrosion rate of AZ91D Magnesium alloy, zirconia, which is classified as a biocompatible ceramic, was coated on the alloy surface through electrophoretic deposition (EPD) technique. The effects of alterations in the EPD parameters such as current density, duration time and ZrO_2 particles concentration on coating properties including thickness, morphology and adhesion were then characterized. Moreover, the electrochemical behavior of the coated alloys is evaluated by means of potentiodynamic polarization, immersion test, and electrochemical impedance spectroscopy. The electrochemical results indicated that the corrosion resistance of the coated alloy is enhanced significantly and the obtained film can successfully control the bio-corrosion rate of AZ91D alloy.

Keywords: Magnesium alloy; Biodegradable implant materials; corrosion protection; Zirconia; bio-coatings; electrophoretic deposition (EPD)