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Controlling the Degradation Rate of Biodegradable Mg Implant Using Magnetron-Sputtered (Zr-Nb) Thin Films

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Abstract : In this research, a technique has been developed to reduce the corrosion rate of magnesium (Mg) metal by creating Zr-Nb thin film coatings. In this regard, thin-film coatings of niobium (Nb) zirconium (Zr) double alloy are applied on pure Mg specimens under different processes conditions, such as the change of the substrate temperature, substrate bias, and coating thickness using the magnetron sputtering method. Then, deposited coatings are analyzed in terms of surface features via field-emission scanning electron microscopy (FE-SEM), thin-layer X-ray diffraction (GI-XRD), energy-dispersive X-ray spectroscopy (EDS), atomic force microscopy (AFM), and corrosion tests. Also, nano-scratch tests were carried out to investigate the adhesion of the thin film. The results showed that the (Zr-Nb) thin films could control the degradation rate of Mg in the simulated body fluid (SBF). The nano-scratch studies depicted that the (Zr-Nb) thin films have a proper adhesion with the Mg substrate. Therefore, this technique could be used to enhance the corrosion resistance of bare Mg and could result in improving the performance of the biodegradable Mg implant for orthopedic applications.

Keywords : (Zr-Nb) thin film, magnetron sputtering, biodegradable Mg, degradation rate
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