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Corrosion Protection of Magnesium Alloys for Biomedical Applications

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Magnesium and its alloys have been investigated as potential candidates in the field of biodegradable materials for bone implants. If the Mg corrosion rate is controlled, allowing for a slow dissolution of implants, this might eliminate the need of a second surgery for implant removal. One of the most common and effective ways to control corrosion is the use of coatings.
In this work, a brief review of several coatings developed for this purpose is presented. A particular emphasis will be given to a new composite coating, involving an inner oxide layer followed by an outer layer of organic nature, which was tested on magnesium alloys AZ31 and RZ5. The first layer is obtained by anodizing in alkaline solution, whereas the organic layer consists of a new formulation, based on polycaprolactone (PCL), with or without addition of hydroxyapatite nanoparticles. Electrochemical Impedance Spectroscopy (EIS) was used to assess the behaviour of the composite coating during immersion in Hank's solution, showing a remarkable increase in the corrosion resistance, compared to the bare material, with initial impedance values in the range of 10^9 Ω.cm². The polymeric layer was found to reduce significantly the degradation rate of magnesium, whereas the anodized layer does not control, by itself, the corrosion rate, although being effective in establishing bonds for polymer adhesion.

Keywords: Mg alloys; anodized film; corrosion protection; biodegradable coating.

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