Effect of the fluoride species and content of the PEO electrolyte on the corrosion properties of the layers obtained on AZ31 for biomedical purposes

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Abstract

Nowadays, many researchers are looking for a material that could be used as resorbable implants to reduce the number of surgeries without weakening the bone. Magnesium alloys are promising candidates due to their good mechanical properties (e.g elastic modulus close to the bone), but their degradation rate is still considered too high which might cause the loose of the implant mechanical integrity and its early failure. Therefore, a compromise between magnesium dissolution and a sufficient lifetime is required. In this context, it is interesting to develop layers with reinforced mechanical properties but also porous to promote osseointegration and limiting in a certain level the implant dissolution. This double effect can be obtained with Plasma Electrolytic Oxidation (PEO) coatings that normally show a dense inner layer (to maintain resistance) and a porous outside layer (to improve the cell interaction). The inner layer can be improved by addition of fluoride in the PEO electrolyte bath. This study focuses on the effect of fluoride counterion on the barrier layer formed by PEO process on AZ31 alloy.

The tested fluorides are NaF, KF, LiF and Na_2SiF_6. The samples properties were analyzed in sodium chloride solution and physiological electrolytes using Electrochemical Impedance Spectroscopy (EIS). Furthermore, the surface and the cross-section of the samples were analyzed by Scanning Electron Microscopy (SEM) to correlate the samples performance with their morphology.

Keywords: *Plasma electrolytic oxidation; biomedical applications, Fluoride; EIS; SEM.*