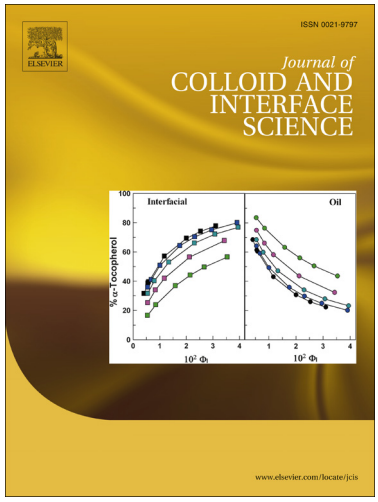

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Incorporation of ZrO_2 particles in the oxide layer formed on Mg by anodizing: Influence of electrolyte concentration and current modes

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Abstract

Hypothesis

The objectives of the present study are to ascertain, particle incorporation during the initial stages of microarc oxidation (MAO), feasibility of increasing the level of particle incorporation through manipulation of process variables and, the use of MgO-ZrO_2 composite coatings either as a pre-treatment or as a post-treatment for MAO coated Mg.

Experiments

Anodic oxide coatings were prepared using 0.3 M NaOH + 15 g/l ZrO_2 and 3 M NaOH + 15 g/l ZrO_2 at 10 V under direct current, pulsed current (PC) unipolar and PC bipolar modes. MAO coatings were prepared using 5 g/l NaOH + 15 g/l Na_2SiO_3 at 250 V under direct current mode for 2 min.

Findings

The study reveals that it is possible to incorporate ZrO_2 particles in the anodic oxide layer, suggesting such a possibility during the initial stages of MAO. When the MgO-ZrO_2 composite coating is used as a pre-treatment, it helps to reduce the size and density of the pores of the MAO coatings and increased the corrosion resistance. When it is used as a post-treatment, lamellar shaped $Mg(OH)_2$ with a very high surface area is formed on the surface, which would be beneficial to impart a better bioactivity and to facilitate immobilization of biomolecules.

Key words: Anodizing; interfacial reactions; particle incorporation; composite coatings; microarc oxidation; surface modification; pre-treatment; post-treatment; corrosion resistance; biomedical applications.

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