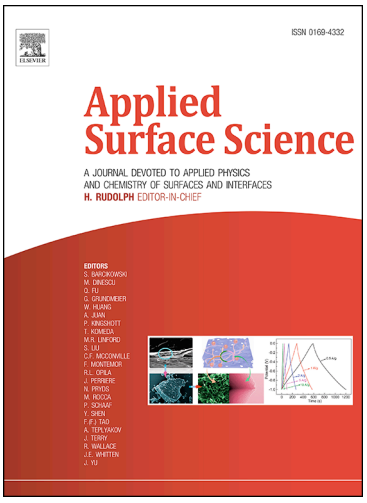

Full Length Article

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Comparative study on microstructure and corrosion behavior of nanostructured hydroxyapatite coatings deposited by high velocity oxygen fuel and flame spraying on AZ61 magnesium based substrates

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Abstract

Hydroxyapatite coatings are biocompatible, osteoconductive and create a corrosion resistance surface on magnesium-based implants. Thermal decomposition of HA during thermal spraying limits its application. To overcome the challenges associated with thermal decomposition of HA during thermal spraying, high velocity oxygen fuel spraying with a good thermal stability for HA is proposed. In this work, the traditional flame spraying was compared to high velocity oxy-fuel (HVOF) for HA depositions on magnesium alloy substrates. The effect of process on microstructure, morphology, corrosion behavior and cellular response of HA layers were evaluated. X-ray diffraction analysis showed that the amount of secondary phases in the HVOF deposited sample was less than that in the flame sprayed coatings. Elemental weight percentage of calcium in corroded surfaces was 21% and 34.5% for HVOF and flame sprayed coatings, respectively. Contrary to the results of the electrochemical impedance spectroscopy measurements for HVOF coating performed during the early hours of immersion in the simulated body fluid (SBF), flame sprayed coating exhibited lower corrosion rate after 5 h immersion in SBF solution.

Keywords

Magnesium, Corrosion rate, Hydroxyapatite, HVOF, Flame spraying

1. Introduction

Magnesium (Mg)-based alloys are biodegradable bio-metals which have recently gained great attention [1-3]. High rate corrosion of these interesting alloys is a major challenge. Coating of surface is a way for reduction of the rate of corrosion [4, 5]. Several investigations dealing with Mg-based alloy implants coated with HA are also of interest [2, 6, 7].

Hydroxyapatite (HA) is a well-known bioceramic which is greatly used for a range of biomedical applications, in particular orthopedic [8]. The main problem associated with the application of HA, is its brittle nature, which limits its medical application. Therefore, it is often applied as