GROWTH OF POROUS ZIRCONIA ON BIOMEDICAL Ti-6Al-4V ALLOY BY PLASMA ELECTROLYTIC OXIDATION

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SUMMARY

Titanium and its alloys are extremely used on implantable materials, in special as orthopedic and dental devices, due to their optimal combination of high strength-to-density ratio, relatively low Young modulus, good corrosion resistance and recognized biocompatibility [1]. However, Ti alloys are bioinert materials, lacking bioactive integration with bone cells and tissues. A possible way to overcome this drawback is by coating the metallic surface with selected oxide layers, such as, zirconia (ZrO_2), which possesses biocompatible and osteoinductive properties, as well as high wear resistance. In this scenery, Plasma Electrolytic Oxidation (PEO) can be considered as an important tool as it allows the deposition of porous ceramic coatings with adjustable composition and morphology [2,3]. The aim of this study was to produce porous zirconia coatings on the biomedical Ti-6Al-4V alloy by PEO treatment. Disk-shaped samples of Ti-6Al-4V (ASTM F136), with dimensions of ϕ10 mm x 3 mm, were used as substrate. The electrolyte was composed of 0.08 mol.L^{-1} of zirconium oxide (ZrO_2) and 0.04 mol.L^{-1} of potassium hydroxide (KOH). The PEO treatments were performed in a system consisting of a pulsed voltage source (MAO-30), a water-cooled stainless steel tank, and a suspended electrode. The surface treatments were carried out at voltages between 300 V and 500 V. Surface morphology was determined by scanning electron microscopy (SEM). Semi-quantitative chemical analysis was obtained by X-ray energy dispersion spectroscopy (EDS). Surface characteristics were also evaluated by XRD, contact angle and roughness measurements. SEM/EDS results indicated that the treatment

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produced a clear change in the surface topography, with the formation of round-shaped pores. In addition, EDS revealed the reduction in the atomic proportion of vanadium (alloy element) in the outermost surface layer. Furthermore, zirconium atoms were detected indicating the incorporation of electrolyte species in the coating. XRD, contact angle, and roughness measurements indicated the formation of a coating with suitable properties for use as biomaterials. (Financial support: CNPq and FAPESP)

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