

Handbook on Toxicity of Inorganic Compounds

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CHARACTERIZATION OF COATINGS CREATED ON SELECTED TITANIUM ALLOYS BY PLASMA ELECTROLYTIC OXIDATION

ABSTRACT

The SEM and EDS results of coatings obtained on pure niobium and titanium alloys (NiTi and Ti6Al4V) by Plasma Electrolytic Oxidation in the electrolytes containing of 300 g and 600 g copper nitrate in 1 litre of concentrated phosphoric acid at 450 V for 3 minutes, are presented. The obtained coatings are porous and consist mainly of phosphorus within titanium and copper. For each coating, the Cu/P ratios were calculated. The maximum of that coefficient was found for niobium and Ti6Al4V alloy oxidised in the electrolyte containing 600 g of Cu(NO₃)₂ in 1 dm³ of H₃PO₄ and equaling to 0.22 (wt%) (0.11 (at%)). The minimum of Cu/P ratio was recorded for NiTi and Ti6Al4V alloys oxidised by PEO in electrolyte consisting of 300 g of copper nitrate in 1 dm³ of concentrated phosphoric acid and equal to 0.12 (wt%) (0.06 (at%)). The middle value of that ratio was recorded for NiTi and it equals to 0.16 (wt%) (0.08 (at%)).

Keywords: Plasma Electrolytic Oxidation; PEO; Micro Arc Oxidation; MAO; SEM; Titanium alloy; NiTi

INTRODUCTION

Nowadays the electrochemical treatments, such as electropolishing (EP) [1-5], magneto-electropolishing (MEP) [6-13], high-current density electropolishing (HDEP) [14-15] as well as Plasma Electrolytic Oxidation (PEO) known also as Micro Arc Oxidation (MAO) [16-30] of biomaterial surfaces are very often used due to the biocompatibility effect. Most important is to fabricate the porous surface enriched in antibacterial elements such as silver and/or copper [30-35] with the least amount of toxic elements to the human body, such as vanadium, aluminum, and nickel [30, 36-43]. According to these requirements the best metallic biomaterials are metals such as titanium, niobium, zirconium, tantalum and their alloys [16-22]. However, till now the biomaterials such as titanium alloys, NiTi and Ti6Al4V, containing harmful

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