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Calcium-phosphate coatings deposition on titanium and Ti-15Mo by plasma electrolytic oxidationLyubov SNIZHKO¹, Oksana Banakh², Tony Journot³, Oleg Kalinichenko¹,
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In this work, the relationship between a composition of the calcium-phosphate containing electrolytes and a composition of the coatings produced from these electrolytes on commercially-pure titanium (CP-4) and Ti-15Mo alloy by plasma electrolytic oxidation was studied. The surface morphology and phase composition of the anodized layers were investigated.

Eleven series of electrolytes, resulting in different Ca/P mass fraction, were investigated. Each series was prepared from two salts containing calcium and phosphorus compounds, e.g. calcium acetate and sodium pyrophosphate, calcium oxalate and sodium tripolyphosphate. The mass fraction ratio of Ca/P in every series was changed in the range between 1 and 6. Coatings were obtained using the same electrical conditions (galvanostatic regime with an average current density of 400A/m² and positive pulses of 50Hz, time of electrolysis 15 min).

The incorporation of Ca and P ions into a growing oxide layer was confirmed by means of XRF and EDS analyses. Regardless the electrolyte composition, linear dependence between the Ca/P mass fraction in the electrolyte and the atomic Ca/P ratio in coatings was observed. It was found the electrolytes resulting in the highest Ca/P ratio in the coatings are (Na₃PO₄×12H₂O + CaC₄H₄O₆) and (Na₃PO₄×12H₂O+ Ca(OH)₂).

The coatings bioactivity, studied by an immersion of the coatings in a simulated body fluid (SBF), will be discussed. The Ca and P ions release from an oxidized layer was observed after SBF tests, which indicates that the coatings are bioresorbable. The coating surface morphology was also significantly changed.

Keywords

titanium

Ca-P coatings

bioactivity

PEO

SBF-test