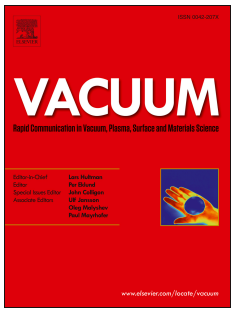
Accepted Manuscript



Improvement of the mechanical behavior of the calcium phosphate coatings deposited onto Ti_6Al_4V alloy using an intermediate TiN/TiO_2 bilayer

Alix Quirama, Aida M. Echavarría, J.M. Meza, J. Osorio, Gilberto Bejarano

PII: S0042-207X(17)31232-0

DOI: 10.1016/j.vacuum.2017.09.024

Reference: VAC 7600

To appear in: *Vacuum*

Received Date: 7 June 2017

Revised Date: 8 September 2017

Accepted Date: 13 September 2017

Please cite this article as: Quirama A, Echavarría AM, Meza JM, Osorio J, Bejarano G, Improvement of the mechanical behavior of the calcium phosphate coatings deposited onto Ti_6Al_4V alloy using an intermediate TiN/TiO_2 bilayer, *Vacuum* (2017), doi: 10.1016/j.vacuum.2017.09.024.

Improvement of the mechanical behavior of the calcium phosphate coatings deposited onto Ti_6Al_4V alloy using an intermediate TiN/TiO_2 bilayer.

Alix Quirama[a], Aida M. Echavarría[a], J. M. Meza[c], J. Osorio[b] and Gilberto Bejarano[a]

[a] Engineering Department, University of Antioquia, Calle 62 No. 52-59, Medellín, Colombia

[b] Exact and Natural Sciences Department, University of Antioquia, Calle 62 No. 52-59, Medellín, Colombia

[c] Materials and Minerals Department, National University of Colombia, Carrera 80 No 65-223, Medellín, Colombia.

Abstract

Calcium phosphate coatings ($CaPO_4$) are widely used in the manufacture of diverse types of osseous implants. However, the $CaPO_4$ deposited by most manufacturing methods presents low adhesion and low crystallinity, which makes it difficult to apply immediately without further treatments. In this research, adherent and crystalline TiN/TiO_2/HA coatings were deposited onto Ti6Al4V alloy substrates without the necessity of carrying out additional treatments of the coated samples. The reactive magnetron sputtering technique was used for the deposition of the coatings applying a 13.56 MHz rf power of 650 W to the HA target and a DC power of 1.2 kW to Ti target (99,9% of purity). The compositional and microstructural analysis of synthetized coatings were performed using FTIR, microraman, XRD, SEM/EDS and AFM characterization techniques. The hardness, elastic modulus and adhesion of individual coatings were studied and analyzed using nanoindentation and scratch tests in order to elucidate the effects of these on the adhesion of the composite coatings. It was found that the deposited HA coatings have a crystalline structure obtained by appropriate adjustment of the deposition parameters without requiring a posterior heat treatment. Also the inclusion of the TiN/TiO_2- bilayer improved the adhesion strength of the whole coating system.

Keywords: calcium phosphate, biocompatible coatings, heat treatment, adhesion and crystallinity.