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Analysis of growth of calcium phosphate coating on Ti-7.5Mo alloy using AFM

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Abstract – Titanium and titanium based alloys are considered bioinerts because when they are inserted in human body they are generally encapsulated by fibrous tissue and they cannot form a chemical bond with bone. As a result, researches for to improve bioactivity of these materials, such as apatite coatings by biomimetic method, have been studied. Calcium phosphate (Ca-P) coating on the surface of samples can be seen in samples were immersed in SBF (Simulated Body Fluid) for 7 (Fig.1) and 14 days (Fig.2). It was found that surface roughness affected the apatite formation and rough topography exhibited better results.

Titanium and its alloys have been used in dentistry due their excellent corrosion resistance and biocompatibility. However, titanium coating is bioinert material and it cannot bond chemically to bone tissue. The purpose of this work was evaluated bioactivity of Ti-7,5Mo alloy after alkaline treatment, heat treatment and soaking in SBF. Ingots were obtained from titanium and molybdenum by using an arc-melting furnace. They were machined to achieve microstructure and morphology next to dental implants. Roughness media (Ra) was measured by roughness meter (1.3 µm and 2.6 µm) and discs (13 mm in diameter and 4 mm in thickness) were cutting for each one. Samples were divided in two groups according roughness, 1.3 µm and 2.6 µm. For alkaline surface treatment, samples were immersed in NaOH aqueous solution with 5.0M at 80ºC for 3 days, washed with distilled water and dried at 40ºC for 24h. After alkaline treatment samples were heat treated at 600ºC for 1h in a electrical furnace in air. Then, all samples were immersed in SBF (Simulated Body Fluid) for 7 and 14 days to form a calcium phosphate (Ca-P) coating on the surface. Surfaces were characterized by using atomic force microscopy (AFM). Analysis indicates that the surface was covered with a thin sodium titanate layer after NaOH treatment and the chemical treatment of different surfaces to expose reactive groups on the material surface and create nanoscale topography. These Ca-P deposits grew up in nano-scale after 7 and 14 days on both roughness . With increasing immersion time, the packing of Ca-P deposits with size of tens of nanometers in diameter formed larger globules and then a continuous Ca-P film on titanium substrates. It was found that surface roughness affected the calcium phosphate formation .The results indicate that calcium phosphate could form on surface of Ti- 7.5Mo experimental alloy with better hidrofilicity for 2.6 µm.

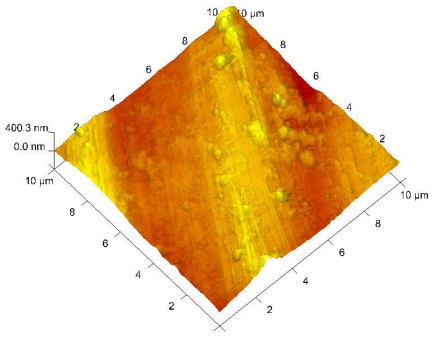

Figure 1: Calcium phosphates coating in samples were immersed in SBF for 7 days.

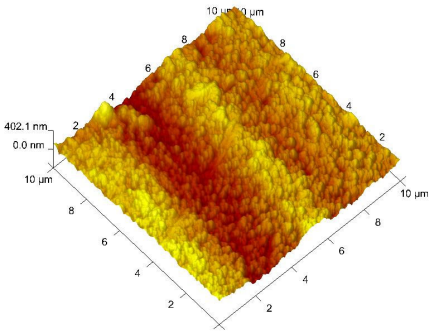

Figure 2: Calcium phosphates coating in samples were immersed in SBF for 14 days.

[1] F Barrere, M.M.E Snel, C.A. Blitterswijk, K Groot and P Layrolle, Biomaterials 25 (2004) 2901–2910