SURFACE MODIFICATION OF THE TI6AL4V ALLOY FOR BIOMEDICAL APPLICATION.

Juan Guilhermo Martim[1], Walter Kenji Yoshito[2], José Hélio Duvaizen[2], Hidetoshi Takiishi[2], Margarida Juri Saeki[1]
[1] Universidade Estadual Paulista "Júlio de Mesquita Filho" (UNESP), Brazil
[2] Instituto de Pesquisas Energéticas e Nucleares (IPEN), Brazil

The aim of this work is to modify the Ti6Al4V titanium alloy by deposition of TiO_2 thin films (with and without calcium) and apatite. The presence of apatite, including hydroxyapatite (HA), in implant materials is important since it is the main mineral component of the bone and plays an important role on biomineralization, namely: the bioactivity and reabsorption of apatites induce a specific biological response on the interface with the living tissue which allows a chemical bond formation. Such chemical bond is fundamental on integration activation, connection between neoformed bone and implant surface, which ensures a good mechanical anchorage. This anchorage also depends on the micromorphological surface structure. In this work, the mentioned alloy surface was modified by chemical treatment followed by TiO_2 thin film deposition, with and without calcium and apatite, by sol-gel method combined to *dip coating* technique (immersion). After each deposition, the materials were treated under temperatures previously established by thermal analysis (TG/DTA) of both precursors. Then, the surfaces were characterized by Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray elemental analysis (EDX), X ray diffractometry (XRD) and also by Fourier Transformed Infrared Spectroscopy (FTIR). Adhesion tests in the films were performed by *pull off* technique. Electrochemical methods (polarization curves) were applied in order to evaluate the behavior of the surfaces under corrosion in balanced saline Hank's solution. Finally, cytotoxicity tests were done based on cellular viability of L929 fibroblasts arranged in contact with the modified surfaces. This project brought several challenges, such as the materials synthesis and application test. The synthesis results show that it was possible to obtain TiO_2 with two crystallographic structures (anatase and rutile), and also a compound with calcium. The apatite shows to be rich in hydroxyapatite. The TiO_2 stands out when it is applied over the metallic substrate while the presence of apatite in the coating is demonstrated just indentifying phosphorus and calcium by EDX. The heat treatment produces changes in the relative amounts of alpha and beta phases of titanium alloy. The adhesion and covering over the metallic substrate is at least satisfactory in the sense that the glue used in the adhesion test procedure does not remove the coating material. The biological test shows that the modifications were not toxic.

Keywords: Biomaterials; Titanium; Alloy; TiO_2; Apatite.

Presenting author's email: mjsaeki@ibb.unesp.br