IIIa08-007

Novel Ti-5Mo-Nb system alloys, with low Young's modulus, for biomedical applications

Cardoso, G.C.(1); Zambuzzi, W.F.(1); Grandini, C.R.(1); Corrêa, D.O.G.(1);
(1) UNESP;

Due to the fast-growing proportion of elderly people, as well as the increasing number of accidents, the need for devices used in the replacement of failed hard tissues such as hip joints and dental implants is increasing. Metallic biomaterials are widely used for this purpose and titanium alloys receive much attention due to their high mechanical strength, good corrosion resistance, low toxicity, and excellent biocompatibility. Ti-cp and Ti-6Al-4V alloy are widely used as materials for implants, however, vanadium has a certain cytotoxicity and aluminum may be associated with some neurological disorders. Therefore, the search for new titanium alloys, without aluminum and vanadium, and with low values of modulus of elasticity has been increasing. Molybdenum and niobium are two non-cytotoxic beta-stabilizing elements that reduce the elastic modulus of Ti alloys. The objective of this work was to develop and characterize alloys of the Ti-5Mo-xNb system, varying the percentage by weight of niobium from 0% to 30%. The ingots were produced by arc- melting, with a controlled argon atmosphere. Then, they underwent a homogenization heat treatment at 1,000 °C, for 24 h, in a vacuum of 10-7 torr. Subsequently, the ingots were hot rolled to obtain a regular shape. The final stage of the samples was obtained after an annealing heat treatment at 1,000º C, for 6h, in a vacuum of 10-7 torr. Information on the structure and microstructure of the alloys was obtained by X-ray diffraction, optical micrographs, and SEM images. For mechanical characterization, analyzes of Vickers microhardness and dynamic elastic modulus were performed. Biological tests of MTT and crystal violet evaluated the viability and adhesion of osteoblastic cells in contact with the samples. The results indicated that, as the addition of niobium increases, the amount of beta phase also increases. The elastic modulus values remained below the CP-Ti, decreasing with the addition of niobium. All the samples were not cytotoxic in in vitro tests. The analyzes showed that the produced alloys have potential for biomedical applications.