TITANIUM ALLOYS WITH ULTRAFINE GRAINS FOR BIOMEDICAL APPLICATIONS

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Abstract

Titanium and its alloys have been increasingly used as biomaterials for implant due to its excellent corrosion resistance, remarkable specific resistance, free of allergenic problems and maximum biocompatibility when compared to other competing biomaterials. Among the Ti alloys, the beta-type stand out, since they contain beta-stabilizing elements such as Nb and V, and modulus of elasticity lower than the other competing alloys and closer to the modulus of the bone. More recently, ultrafine-grained (UFG) Ti alloys have been produced by severe plastic deformation (SPD). Such UFG materials have superior properties to their coarse grained equivalent, exhibiting an improvement in wear resistance and a good combination of high strength and ductility at room temperature. In this context, this work presents results of the processing of the Ti-30Nb-4V alloy by high pressure torsion (HPT), where the load was varied, keeping the number of turns constant. X-ray diffraction results show that the α-Ti phase is gradually transformed into β-phase when increasing the load. In the same sense, the hardness increases, indicating an important grain refining, which is confirmed by phase maps analyses in a transmission electron microscopy (TEM) equipped with an ASTAR system. Furthermore, through the Vickers microhardness test and the microstructural characterization, no significant variation of strain is observed along the radius of the sample.

Keywords: Severe plastic deformation, high pressure torsion, ultrafine granulation, Ti-30Nb-4V.