DEVELOPMENT OF NEW β Ti-25Ta-Zr ALLOYS FOR BIOMEDICAL APLICATIONS

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ABSTRACT

Titanium is a transition metal that has an allotropic transformation around 883 °C. Below this temperature, its crystalline structure is a hexagonal compact (α phase). Above this temperature, it has a body-centered cubic crystalline structure (β phase). Zirconium has an allotropic transformation similar to titanium at around 862 °C, and tantalum has a body-centered cubic crystalline structure. The objective of this study was to produce Ti-25wt%Ta alloys as a base material, varying zirconium (0, 25, and 50wt%). The Ti-25Ta-xZr alloys were prepared in an arc-melting furnace with a non-consumable tungsten electrode and water-cooled copper crucible in argon-controlled atmosphere. The microstructural analysis was performed by x-ray diffraction (XRD), optical (OM) and scanning electron microscopy (SEM). The mechanical properties were analyzed by microhardness and Young's modulus measurements. XRD analysis revealed the presence of the martensite α" phase (orthorhombic) in the alloy without Zr; the α" + β phases for alloys with 25 wt% Zr and only β phase for alloy with 50 wt% Zr. These results were corroborated by the microscopy results, with a microstructure composed of grains of the β phase and needles of the α" phase in the intragranular region. The values of hardness were greater than the cp-Ti due to the action of the substitutional elements, restricting the movement of dislocations in the atomic plans. The Young's modulus decreases with the increase in Zr content in the Ti-25Ta-xZr alloys due to the stabilization of the β phase.

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