STRUCTURAL AND MICROSTRUCTURAL CHARACTERIZATION OF Ti-25Ta-10Zr ALLOY

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1. Introduction

Titanium is used in the biomaterials field because of its good biocompatibility and osseointegration, low elastic modulus and excellent resistence to corrosion and wear [1]. Titanium is a transition metal with an allotropic transformation around 883 ºC. Below this temperature its crystalline structure is a hexagonal close-packed (phase α) and above this temperature its structure is body-centered cubic (phase β). Zirconium in titanium alloys, is a neutral element which possesses characteristics similar to titanium. Its allotropic transformation is around 862 °C. Tantalum has only the body-centered cubic structure (phase β) and when added to the alloy will promotes changes in the mechanical properties and microstructure. This paper aims the preparation and characterization (chemical, structural and microstructural) of a ternary alloy containing titanium and substitutional elements as tantalum and zirconium (Ti-25Ta-10Zr alloy).

2. Experimental

After stripping of the precursor, the alloy was melted in an arc-melting furnace, with argon controlled atmosphere, in a copper water-cooled crucible and not consumable tungsten electrode. Then was held the homogenization heat treatment in ultra high vacuum (10^{-8} Torr) where the sample was heated with a 1 ºC/min heating rate until the level of 1000 ºC. The sample was maintained in this temperature for 24 hours and the cooling was done with the furnace off. The characterizations of the sample were performed through of the density measurements, optical and scanning electron microscopies and x-ray diffraction by the Rietveld method.

3. Results and Discussions

The chemical composition and density measurements showed a good quality of the produced sample. The results obtained by x-ray diffraction technique indicate the presence of crystalline structure of phase α' (hexagonal close-packed) and α'' (orthorhombic). The micrographs showed the presence of peculiars small intra-grain needles of the martensitic α' (lamellae) and α'' (needles) phases in both conditions, as cast (Fig. 1) and treated (Fig. 2). The micrographs corroborate the results obtained in x-ray diffraction measurements.

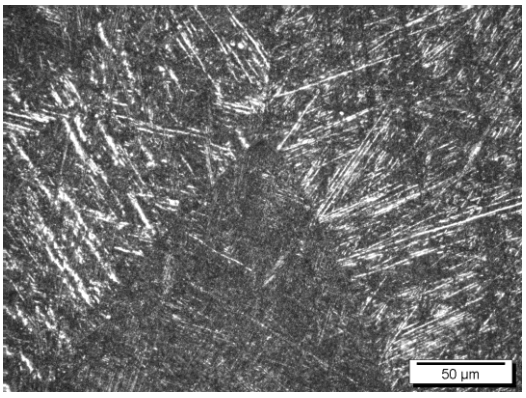

Fig. 1. *Scanning electron microscopy for Ti-25Ta-10Zr alloy in the as-cast condition.*

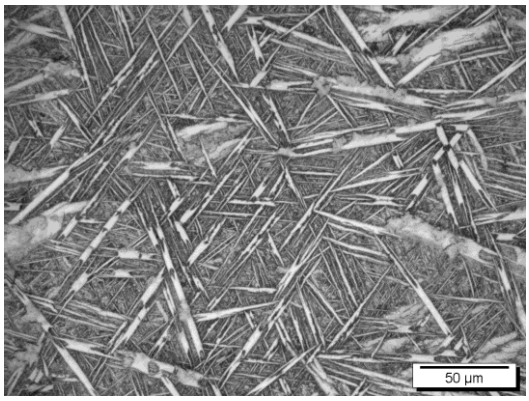

Fig. 2. *Scanning electron microscopy for Ti-25Ta-10Zr alloy after heat treatment.*

4. References

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