MICROSTRUCTURE AND MECHANICAL PROPERTIES OF Ti-10Mo-25Zr ALLOY FOR BIOMEDICAL APPLICATIONS

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1. Introduction

The demand for biomaterials that act in the treatment of fractures in hard tissues has been increasing due to the longevity of life and accident victims. In this scenario, the metallic biomaterials allow a breakthrough because its characteristics are similar to bone [1]. In search of new biomaterials with the most suitable properties, the combination of titanium with substitutional elements that stabilize the beta phase, enables the combination of high strength with low modulus of elasticity. Molybdenum is a good beta stabilizer, needing only 10 wt% to stabilize this phase, and zirconium can improve the stabilization of this phase in combination with another beta stabilizing element, increasing resistance to corrosion and biocompatibility of alloys [2]. Thus, the Ti-Mo-Zr system alloys are being considered for biomedical applications.

2. Experimental

The sample was melted into arc-melting furnace with controlled atmosphere to ensure good homogeneity. It was performed chemical characterization by EDS, ICP-OES and density measurements. The structural and microstructural analyzes were performed using x-ray diffraction by powder method, optical and scanning electron microscopy. Selected mechanical properties were obtained by Vickers microhardness and elastic modulus using Sonelastic® equipment, by the impulse excitation technique.

3. Results and Discussions

The chemical composition of the Ti-10Mo-25Zr performed by density measurements indicate that the stoichiometry of the alloy was obeyed satisfactorily. The analysis by ICP-OES corroborates the density results presenting values close to nominal composition, and the metal impurities present do not show significant concentrations. The EDS spectra reveals only the presence of the alloy elements (Ti, Mo and Zr), which indicates a good sample; and also gave the mapping of the alloying elements in the analysis region, showing a good homogenization. The results of x-ray diffraction were analyzed by the Rietveld method (Fig. 1) and microanalyses only indicate the presence of body-centered cubic crystalline structure (Fig. 2), characteristic of the β phase [3]. Microhardness tests indicate a solid solution hardening. The elastic modulus of the alloy (84 GPa) has lower value than the currently used implants, that is the closest to the human bone (4-30 GPa) increasing the mechanical compatibility. Thus, the results showed a low modulus of elasticity and high hardness and is promising for biomedical applications.

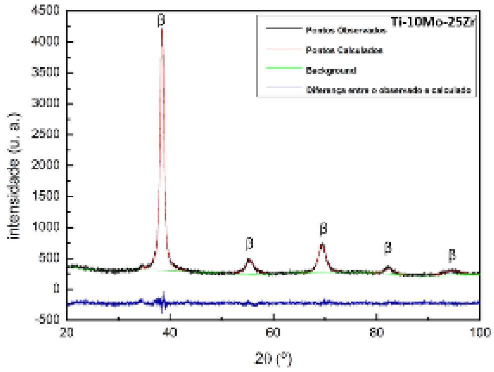

Fig. 1. X-ray diffractogram analysed by Rietveld method.

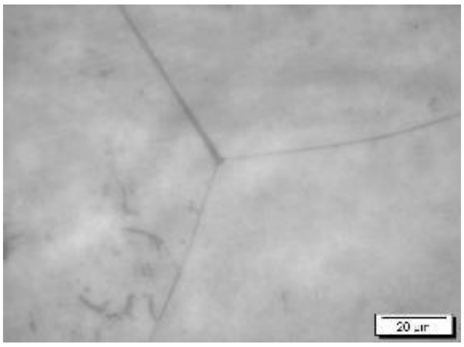

Fig. 2. Optical micrograph for Ti-10Mo-25Zr alloy.

4. References

[1]- M. Geetha et al., Process in Materials Science, **54**, 397-425 (2009).
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[3]- W.F. Ho et al., Materials Science and Engineering C, **32**, 517-522 (2012)

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