INFLUENCE OF ANNEALING HEAT TREATMENT ON HARDNESS AND ELASTIC MODULUS OF TMZ ALLOYS

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1. Introduction

Titanium is well-known as biomaterial because it can promote osseointegration and in addition has excellent mechanical properties for using in biological environment. Titanium has two different structures depending on the temperature, below 862 °C the compact hexagonal crystalline structure (α phase) is stable, above this temperature the structure changes to body-centered crystalline structure (β phase). Recently, many researches were conducted based on metastable beta alloys due to the possibility to change the structure and microstructure and consequently the mechanical properties of these alloys by specific heat treatments [1, 2]. The main goal of this work is to study the effect on selected mechanical properties like hardness and elastic modulus by annealing heat treatment in Ti-10Mo-xZr (x = 5, 10, 15 and 20 %wt.) alloys.

2. Experimental Procedures

The alloys were melted in arc-furnace in argon atmosphere, after that the alloys were submitted to homogenization heat treatment (1000 °C, 10^{-6} Pa vacuum, for 24 hours), hot rolling (1000°C) and annealing heat treatment (1000 °C, 10^{-6} Pa vacuum, for 6 hours). The alloys were characterized by chemical composition analysis, density, x-ray diffraction with Rietveld's method analysis, optical and electron scanning microscopy, microhardness and elastic modulus.

3. Results and Discussions

The chemical composition analysis showed that stoichiometry is close to nominal values. The structure and microestruture characterization revealed a good homogeneity, after hot rolling the β phase is predominant, but small amount of non-stable α' phase was observed. Annealed alloys have a significant α phase quantity in β phase matrix due to slow cooling rate adopted in this processing. In general, the more substitutional zirconium the more β phase in the alloys structure [3]. The microhardness and elastic modulus behavior are according to structure and microstructure, where β phase has high microhardness (Fig. 1) and low elastic modulus values (Fig. 2) than α phase.

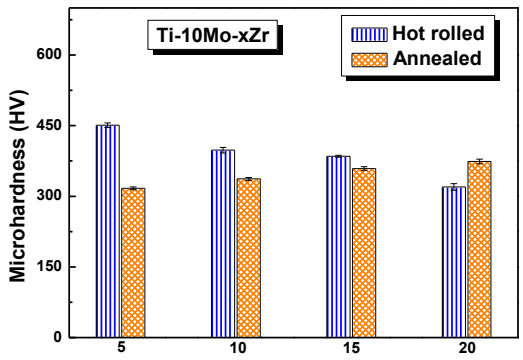

Fig. 1. *Microhardness results of the TMZ alloys.*

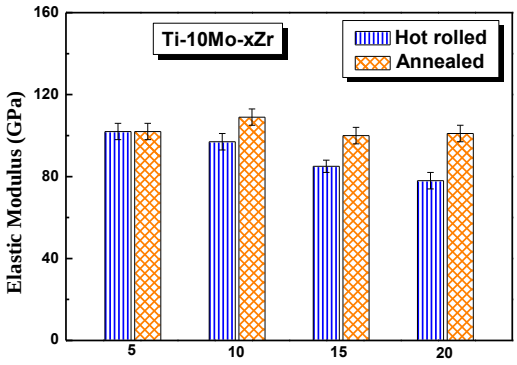

Fig. 2. *Elastic modulus results of the TMZ alloys.*

4. References

[1]- Correa, D.R.N. et al., J. Mat. Res. Tec. **4**, 180-185 (2015).
[2]- Kuroda, P.A.B.; Buzalaf, M.A.R.; Grandini C.R., Mat. Sci. Eng. C **67**, 511-515, (2016).
[3]- Ho, W.-F et al. Mat. Sci. Eng. C **32**, 517-522 (2012).

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