INFLUENCE OF THERMOMECHANICAL TREATMENTS IN SOME PROPERTIES OF Ti-25Ta-Nb ALLOYS

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ABSTRACT

Characteristics such as good biocompatibility, the high relationship between mechanical resistance/density, and good corrosion resistance make titanium and its alloys widely used in the biomedical area. The addition of β-stabilizing elements in titanium alloys such as tantalum and niobium causes a decrease in modulus of elasticity values. However, this reduction can also occur through thermomechanical treatments. This work aims to develop new alloys of the Ti-25Ta-xNb system (x = 10, 20, 30, and 40 percent in weight), studying the influence of thermomechanical treatments on the structure microstructure and some selected mechanical properties of the alloys. The materials were melted in the nominal proportion in an arc-furnace with an inert argon-controlled atmosphere. Subsequently, the ingots were submitted to thermomechanical treatments of homogenization, hot rolling, and annealing. The chemical, structural/microstructural, and mechanical characterizations were performed for each condition of the alloy. The results obtained through elemental EDS mapping, semiquantitative chemical analyses performed with EDS, and density measurements obtained by the Archimedes Principle indicate that the samples present suitable stoichiometry and homogeneity. X-ray diffractograms indicate that the material's crystalline structure was sensitive to the addition of niobium and thermomechanical processing, with the coexistence of the α" and β phases in alloys with up to 20 wt% niobium, and only β phase in alloys with a percentage higher than 30 wt% by niobium. Micrographs (obtained by optical and scanning electronic microscopy) corroborated X-ray diffraction measurements. The values of modulus of elasticity

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(obtained by the impulse technique) of all the studied alloys are lower than the alloys usually commercialized nowadays, such as cp-Ti and Ti-6Al-4V. Therefore, the alloys studied in this work are attractive to be used as biomaterials. The Ti-25Ta-40Nb alloy is the most attractive among them due to its low modulus of elasticity value.

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REFERENCES

F.F. Quadros, P.A.B. Kuroda, K.S.J. Sousa, T.A.G. Donato, and C.R. Grandini, Journal of Materials Research and Technology 8, 4108 (2019).

Ş. Çallıoğlu and P. Acar, Materials Science and Engineering: C 110, 110715 (2020).

L.-Y. Chen, Y.-W. Cui, and L.-C. Zhang, Metals 10, 1139 (2020).

N. Yumak and K. Aslantaş, Journal of Materials Research and Technology 9, 15360 (2020).