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EFFECT OF HEAT TREATMENT AND OXYGEN DOPING ON STRUCTURE, MICROSTRUCTURE, HARDNESS AND ELASTIC MODULUS OF TI15NI ALLOY

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Effect of heat treatment and oxygen doping on structure, microstructure, hardness and elastic modulus of Ti15Ni alloy D. Cascadan*1,2, M. A. R. Buzalaf3, C. R. Grandini1,2 ¹ UNESP – Univ. Estadual Paulista, Laboratório de Anelasticidade e Biomateriais, 17.033-360, Bauru, SP, Brazil 2INTN/Br – Institute of Biomaterials, Tribocorrosion and Nanomedicine – Brazilian Branch, 17.033-360, Bauru, SP, Brazil 3USP, Faculdade de Odontologia, Departamento de Ciências Biológicas, 17.012-901, Bauru, SP, Brazil Keywords: Ti alloys, biomaterials, microstructure Ti-15wt%Ni alloy can be used as a biomaterial because the addition of nickel enhances the mechanical strength, corrosion and wear resistance of cp-Ti. Among properties of a biomaterial, elastic modulus and hardness are very important and, varies according to microstructure and the amount of interstitial elements such as oxygen and nitrogen. For this purpose, it was used thermal and mechanical treatments. The heat treatments are used to obtain a homogeneous microstructure, free of internal stresses, but also to modify the amount and proportion of the phases. Mechanical treatments are required to perform tests that need symmetrical samples. In this work, Ti-15wt%Ni alloy were obtained by melting of commercially pure metals in an arc furnace under argon inert atmosphere. To verify the composition of the alloy, chemical analysis was performed by optical emission of induced plasma. Then, the sample was subjected to a homogenizing heat treatment at 870 °C for 24 hours with heating and cooling rate of 15°C/min in preparation for hot rolling, made at 870 oC. Again, it was performed new heat treatment to relieve the internal stresses arising from the hot-rolling process. The treated samples were divided and each suffered doping processes with oxygen at different temperatures and partial pressures. For the characterization of the samples were performed x-ray diffraction in a Rigaku diffractometer. For microstructural analysis, the samples were prepared according to standard metallographic procedure and SEMs were performed by an EVO/EVO LS15 microscope. The oxygen and nitrogen analyzes were obtained by melting under inert gas in a LECO TC-400 equipment. Hardness tests were performed with a Shimadzu HMV microdurometer, under load of 1.9 N by 60s. The dynamic elastic modulus was obtained from the free oscillations using Sonelastic® equipment. The obtained sample respected the purpose stoichiometry, with small amounts of other metallic impurities. Its XRD patterns show that the alpha phase of titanium is predominant beyond of the Ti4Ni2O oxide, whose proportions changed with the processing. The micrographs show the Ti4Ni2O oxide in a matrix of eutectoid microstructure composed by alpha and Ti2Ni intermetallic phases. Images by EDS show higher concentrations of nickel in the Ti4Ni2O precipitates and higher concentration of titanium in the matrix alpha + Ti2Ni. Concentration of oxygen and nitrogen elements and microhardness are variable in each processing step. However, there were no significant changes in the values of elastic modulus. (Financial support: Capes, CNPq and FAPESP).