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PROCESSING AND CHARACTERIZATION OF A NOVEL HIGH ENTROPY ALLOY FOR POTENTIAL USE AS IMPLANTABLE MATERIAL

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Biomedical titanium alloys have been developed mainly for orthopedic and dental implants, combining better mechanical and electrochemical properties, and also biocompatibility than other commercial biomaterials. However, the actual titanium alloys do not avoid completely common problems happened in implantable materials, such as stress shielding effect and toxicity by the release of metallic ion debris at long-term use. In the last years, high entropy alloys (HEAs), composed by at least five elements in proportion near equimolar, have been employed for aviation and structural industries. HEAs have been recognized by their high strength, ductility and corrosion resistance, which has attracted attention by the biomedical industry. However, the properties of the developed HEAs do not match with the requirements for use as a biomaterial. Furthermore, there are not a deep understanding of the mechanisms of crystallization and solidification of these materials, neither the interactions between their surfaces with human bone cells and tissues. This work aims to prepare and characterize a novel biomedical HEA, composed by non-toxic elements (Ti, Nb, Zr, Ta, and Mn), in equiatomic proportion, for possible application as biomedical implants. The ingots were produced by arc-melting in a controlled atmosphere of argon and water-cooled crucible. Chemical composition was evaluated by gas analysis, ICP-OES, EDS, chemical mapping and density measurements. Crystalline structure and microstructure were analyzed by XRD, OM, and SEM. The results indicated good quality on the processed sample, despite the difficulty in their melting process, and also low content of impurities. The sample presented high density as the theoretical values and crystalline structure and microstructure were different from their metallic forms. The produced sample showed good preparation conditions and had the potential to combine good mechanical properties to be used as orthopedic or dental implants, in addition to encouraging future studies in the area. (Financial support: CNPq, FAPESP, and FUNDUNESP).