Performance Analysis of Ti-Nb-Zr-Ta to Development Medium Entropy Alloys by Powder Metallurgy

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ABSTRACT

The field of biomedical high entropy alloys has become a vital area because they can make human life easier. The most alloys used in biomedical application are Ti6Al4V due to the titanium element. Pure titanium (CP-Ti) has excellent corrosion resistance but the titanium and its alloys have high price [1, 2]. High Entropy Alloys (HEAs) are defined as alloys that consist of five main elements or more mixed in an equiatomic, near-equiatomic and equimasic fraction [3]. The behavior is being investigated for high entropy alloying elements and the design methods. Powder metallurgical techniques can be used to obtain HEA based on compatible alloy for biomedical applications with uncomplicated and inexpensive way to process. The demanded alloys for biomedical applications are excellent in plasticity, low in Young modulus, and high in strength; the alloy components are low-toxicity and are completely free from them. Many HEAs have superior mechanical properties, microstructure and good biocompatibility [4-7], in contrast to Ti6Al4V when used for bone implants; it has been shown that there is significant bone wear. Besides, aluminum and vanadium can have adverse effects on the human body [8]. In this work, a medium entropy alloys (MEA) base on Ti-Nb-Zr-Ta system ($Ti_{25}Nb_{25}Zr_{25}Ta_{25}$) has been studied using conventional powder metallurgy techniques. Their microstructure, mechanical properties and chemical properties have also been studied. The results obtained demonstrate the influence and performance of equiatomic and equimasic of these alloys and their ability to work successfully for possible use as biomedical implants.

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