

The effect of alloying elements on densification and mechanical behaviour of titanium based alloy

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Abstract

The allotropic behavior of titanium is affected by many factors such as processing temperature and alloying elements. Using processing method with parameters that enhances properties of the resulting alloy is imperative. In this study, CP-Ti, binary systems Ti-1Nb, Ti-1Zr and ternary Ti-1Nb-1Zr, were produced using spark plasma sintering method at 1200°C at the heating rate of 100°C/min, a 10 min holding time and pressure of 50 MPa. The microstructures were analyzed by an optical microscope and scanning electron microscope and the XRD was used to examine phases formed. Furthermore, the microhardness and the compressive behavior of the materials were analyzed for mechanical properties. The microstructures obtained were of a phase for the CP Ti and Ti-1Nb binary alloy, and it was found to be a for Ti-1Zr and Ti-1Nb-1Zr. The a alloys had relatively the highest hardness at about 218HV and 225 HV for Ti-1Zr and Ti-1Nb-1Zr respectively. The developed alloys had densities above 99%. The results also showed that even at low additions, Zr and Nb improved the properties of CP-Ti, making them good contenders for biomedical implant applications.