The effect of heat-treatment on microstructures and mechanical properties in Ti-8.5Nb-4.5Ta-13Zr alloy.

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Abstract:
Ti and its alloys exhibit excellent combination of physical, chemical, mechanical and biological properties, which makes them a competitive and attractive material for biomedical application. In fact, the mechanical behavior of the Ti alloys depends on the morphology, phase distribution and final microstructure, which are affected by the parameters of heat-treatment. Ti-8.5Nb-4.5Ta-13Zr alloy was investigated aiming to evaluate the effects of heat-treatment on the phase transformations, microstructure and mechanical properties. The Ti alloy was produced by powder metallurgy using hydride powders and were homogenized by high-energy milling. The samples were cold-isostatically pressed and sintered at 1150 °C for 10 hours under high vacuum. After sintering, the samples were cooled down in furnace, air and water. Phase formation and microstructural characterization were performed by XRD and SEM, respectively. Mechanical property analyzed were Vickers hardness and elastic modulus. The microstructure of Ti-8.5Nb-4.5Ta-13Zr alloy consists of beta-phase matrix and alpha-phase region of two structures: equiaxed and needle-like grains, known as Widmanstätten structure. The precipitation of the alpha-phase in the beta-phase matrix led to an increase in elastic modulus and Vickers hardness of the alloy, which was cooled down in the furnace. Moreover, a few remaining pores were still found and density above 95% was achieved.