Beta-transus temperature identification and atmosphere influence evaluation in beta-matrix metastable alloy TMZF.

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The main goal of this work was to validate a simple method to determine the beta-transus temperature of Ti-12Mo-6Zr-2Fe (commercially known as TMZF), a beta-matrix, metastable titanium alloy, with huge potential for implants application. Aside from the well-known stress-shielding effect, consequence of the difference between the Elastic Modulus of the human bone and multiple implant's alloys, recent studies found that some components (such as Al and V in Ti-6Al-4V) used in this alloys can be hazardous for the human body. Hence, beta-matrix metastable alloys (which have lower Elastic Modulus) that do not contain any of these elements (such as TMZF) appear to be a good replacement for the currently used alloys. The method used consisted in a simple thermal treatment: heating samples up to multiple temperatures, leaving them for 8 hours at said temperatures and subsequently quenching them into water. The treatments were followed by microstructural analysis to assess the precipitation of alpha phase, and thus, estimate the beta-transus temperature. Vickers microhardness test were also conducted. Afterwards, the influence of the atmosphere was analyzed by taking samples above the estimated temperature of phase transformation (and also above the temperature found in the literature) and thermally treating them in regular atmosphere and in vacuum. In this step however, some samples showed precipitation in both atmospheres. Because of the unexpected results, X-Ray Diffraction of these samples was made in order to identify the phases and better explain the microstructural results.