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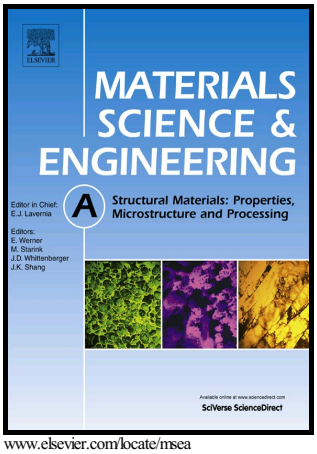

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Thermo-mechanical processing, microstructure and mechanical properties of TiZrB alloy

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Abstract

This work was aimed in the relationships investigation among the microstructure, the tensile properties and the thermo-mechanical processing of a novel Ti-25Zr-1B (wt%) alloy. The alloy was evaluated under different conditions (as-cast, hot-rolled and hot-rolled-annealed). The XRD diagrams demonstrated that all specimens were completely consisted of the α and TiB phases. The results of EDS indicated that the TiB phase dissolved a certain amount of Zr, which was in agreement with the existence of TiB peaks shifting towards lower diffraction angles. The as-cast Ti-25Zr-1B alloy microstructure and the size, the morphology, the orientation, and the distribution of the TiB particles could be significantly altered by the hot-rolling process. The hot-rolling process provided an ultimate strength increase of at least 7 pct and the elongation-to-failure increase of 135 pct relatively to the as-cast sample. In addition, the annealing heat treatment could effectively modify the mechanical properties of the hot-rolled sample. The strength decreased and the elongation-to-failure increased as the annealing temperature increased, while the temperature was below 800°C. In contrast, as the annealing temperature increased to 900°C, the alloy demonstrated appreciably lower elongation-to-failure and higher strength compared to the annealed form at 800°C. The mechanical properties variation of the Ti-25Zr-1B alloy series was ascribed to the microstructure evolution of the matrix alloy as well as to the morphology and volume fraction changes of the TiB particles.

Key words: Titanium alloys; Hot-rolling; Annealing; Microstructure; Mechanical properties