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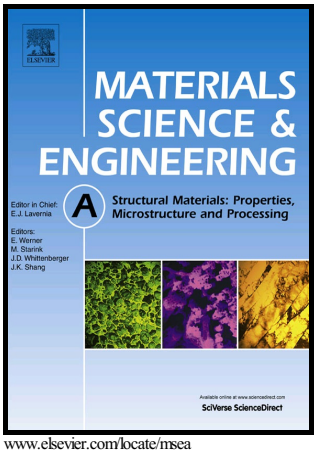

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Enhanced mechanical properties for mill-annealed Ti-20Zr-6.5Al-4V alloy with a fine equiaxed microstructure

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Abstract

To achieve a better balance of strength and ductility for Ti-20Zr-6.5Al-4V alloy, the fully equiaxed microstructure was obtained by post-deformation annealing process following water quench. The experimental results on microstructure evolution during the applied heat treatment routes are discussed with respect to the mechanical properties.

Keywords

Titanium alloy; thermomechanical processing; mechanical characterization; electron microscopy

1. Introduction

Titanium alloys, particularly two phase alloy which is generally composed of α (hcp) and β (bcc) phases, have become important lightweight materials for aerospace, energy, and chemical processing industries due to their high specific properties and superior corrosion resistance [1]. Two phase titanium alloys can exhibit a variety of microstructures, such as that consisting of lamellar α phase developed during cooling from the high-temperature β field. This kind of microstructure has moderate strength and fatigue crack growth resistance but low ductility. In contrast, a microstructure comprising globular α in transformed β possesses a better balance of strength and ductility for many service applications [2]. According to reference [3], the equiaxed Ti-6Al-4V alloy produced through thermomechanical treatment consisting of extensive deformations followed by annealing exhibits combined strength and ductility properties that exceed the corresponding properties of the lamellar alloy. For Ti-6.5Al-3.5Mo-1.2Zr-0.3Si alloy with equiaxed grains, hot tensile tests results showed that the maximum elongation reaches 400% at 960 °C [4]. Moreover, the latest research by Roy and Suwas [5] showed enhanced superplasticity for Ti-6Al-4V-0.1B by dynamic globularization which led to the