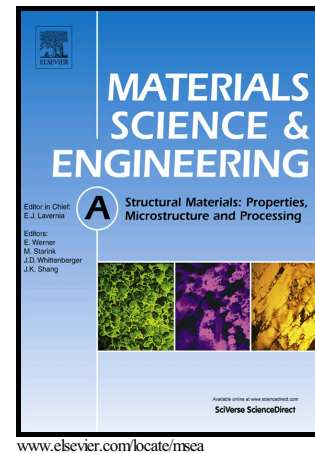


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Thermal stability of an ultrafine grained Ti-6Al-4V alloy during post-deformation annealing

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Abstract

In the current study, a Ti-6Al-4V alloy plate with a supersaturated martensitic starting microstructure was initially warm rolled, producing a gradient ultrafine-grained (UFG) microstructure throughout the thickness: fully equiaxed UFG in the surface layer and a combination of UFG and elongated grains in the center layer. The thermal stability of the warm rolled UFG microstructures was then investigated through the course of post-deformation annealing treatment. Upon annealing, the fully UFG surface layer experienced concurrent α grain growth and β precipitation (i.e. partitioning), whereas the center layer revealed the replacement of partially fragmented α lath by equiaxed grains, most likely through static recrystallization. With increasing annealing time, the overall texture characteristics were mostly preserved for both surface and center layers, apart from a gradual strengthening of the $(0^\circ, 0^\circ, 30^\circ)$ texture component in the surface layer at the expense of the $(0^\circ, 0^\circ, 0^\circ)$ and $(0^\circ, 90^\circ, 0^\circ)$ components. The current post-deformation annealing treatment led to an enhanced tensile elongation of the alloy at the expense of strength, with an increase in the annealing time.

Keywords: titanium alloys; ultrafine-grained materials; annealing; recrystallization; texture evolution; mechanical property

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