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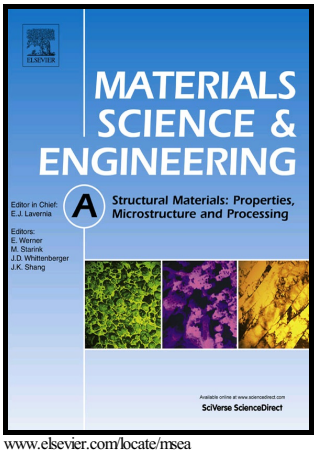

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Effect of cold rolling and subsequent annealing on grain refinement of a beta titanium alloy showing stress-induced martensitic transformation

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Abstract

The influence of cold rolling and subsequent annealing on the microstructure and mechanical properties of a beta titanium alloy with the chemical composition of Ti-4Al-7Mo-3V-3Cr (Ti-4733) was investigated. The cold rolling was applied at room temperature up to 70% thickness reduction without cracking. The stress-induced martensitic transformation and dislocation slip were found to be the deformation mechanisms at the initial stage of deformation. Microstructural examinations revealed that several deformation bands form within the grains and also reverse transformation of α″ to β phase takes place with increasing deformation. The formation of band structures explains the high workability for Ti-4733 at room temperature. A short time annealing of the cold-rolled specimen resulted in a fine-grained structure with the average grain size of 22 μm. The reverse α″ to β phase transformation and recrystallization of deformed β phase are suggested to be the grain refinement mechanisms. The cold-rolled and annealed specimens exhibited enhanced tensile properties, so that the strength and elongation increased from 790