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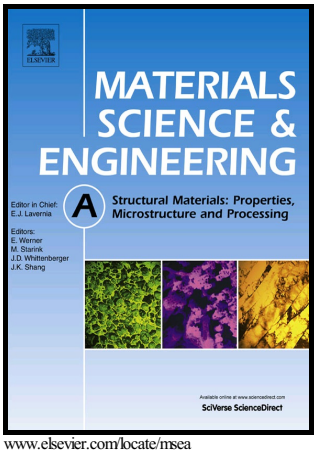

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Grain refinement and superplastic flow in a fully lamellar Ti-6Al-4V alloy processed by high-pressure torsion

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Abstract

A cold-rolled Ti-6Al-4V alloy was subjected to consecutive heat treatments at 1283 K for 1 h and at 823 K for 3 h in order to produce a fully lamellar microstructure. Thereafter, the material was processed by high-pressure torsion (HPT) through various numbers of turns up to a maximum of 30. It is shown that the HPT processing leads to exceptional grain refinement with average grain sizes of ~70 and ~50 nm after 20 and 30 turns, respectively. Tensile testing was conducted at 873 and 923 K with different initial strain rates using the material processed through 20 turns of HPT and this gave a maximum superplastic elongation of 820% at the relatively low temperature of 923 K when testing with an initial strain rate of 5.0×10^{-4} s^{-1}. The associated strain rate sensitivity for this low temperature superplasticity was estimated as $m \approx 0.5$ which is consistent with flow by grain boundary sliding.