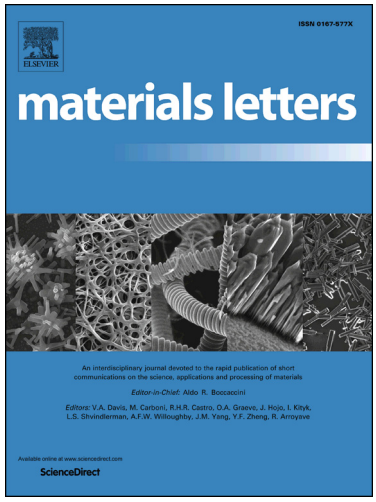

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Flow behavior and constitutive relationship for elevated temperature compressive deformation of a high Nb containing TiAl alloy with (α_2+γ) microstructure

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Abstract

The isothermal compression of a Ti-43.5Al-8Nb-0.2W-0.2B (at.%) alloy with (α_2+γ) microstructure has been examined at temperature range of 950-1050℃ under strain rate range of 10^{-2}-$10^{-5}s^{-1}$. The results showed that the value of m (strain rate sensitivity factor) increased from 0.18 through 0.33 to 0.48 with decreasing diffusion compensated strain rates. This indicates a transition of deformation mechanism from dislocation creep to grain boundary sliding (GBS), which was observed in the microstructure characterization. The transition took place over about one and a half orders of magnitude in diffusion-compensated strain rate may also be predicted by employing unified rate constitutive equations for dislocation creep and GBS in an additive manner.

Key words: Titanium aluminides; Isothermal compression; Grain boundary sliding; Dislocation creep; Microstructure; Simulation and modelling

1. Introduction

γ-TiAl based alloys are widely considered novel light-weight structural materials for applications in aerospace and automotive industries, which possess lots of favorable mechanical properties such as low density, high specific strength and stiffness, good resistance against oxidation and corrosion, and good creep properties[1]. However, due to its intrinsic brittleness and high deformation resistance, γ-TiAl based alloys (especially for the high Nb containing TiAl alloys) can hardly be formed by conventional forging, but isothermal die forging is suit for the thermal-mechanical

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