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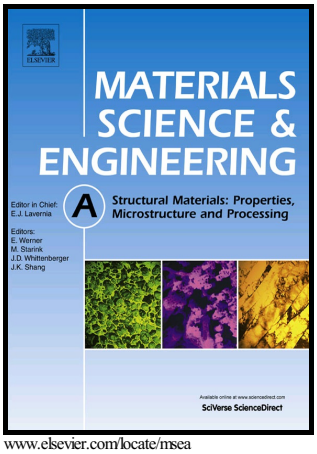

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A microstructure with improved thermal stability and creep resistance in a novel near-alpha titanium alloy

Tongbo Wang1, Bolong Li[1*], Zhenqiang Wang[1,2], Zuoren Nie[1*]

[1]College of Material Science and Engineering, Beijing University of Technology, Beijing 100124, China

[2]Grimed Medical (Beijing) Co. LTD, Beijing 102200, China

blli@bjut.edu.cn

zrnie@bjut.edu.cn

Corresponding author at: College of Material Science and Engineering, Beijing University of Technology. Tel: +86 010 67392498

Abstract

A triple-microstructure with the precipitation of silicide along the α/β phase boundaries and α_2 phase in the Ti-5.8Al-3Sn-5Zr-0.5Mo-1.0Nb-1.0Ta-0.4Si-0.2Er alloy was prepared for improving thermal stability and creep resistance. The alloys were forged at 1050 ℃ and 1000 ℃ followed by solution treatment at 1000 ℃ for 1 h and subsequent ageing at 700 ℃ for 5 h. The effects of α morphology and precipitation characteristics on the thermal stability and creep performance of high-temperature titanium alloy were investigated. A triple-microstructure with the participation of silicide along the α/β phase boundary and α_2 phase was a promising structure with improved thermal stability and creep resistance. The plasticity loss rate was 25.0% after thermal exposure at 650 ℃ for 100 h due to the participation and coarsening of α_2 and silicide. Meanwhile, the plastic creep strain was 0.111% during the creep deformation at 650 ℃ for 100 h with an applied stress of 100 MPa, which was attributed to the inhibition of silicide and α_2 phase for boundary migration and dislocation slipping. Furthermore, the mutual precipitation of coarsening silicide and α_2 phase inside α matrix was a significant reason for the dramatic decrease in the thermal ability, which also worsened the inhibition for dislocation climbing of silicon element during the creep deformation.

Keywords