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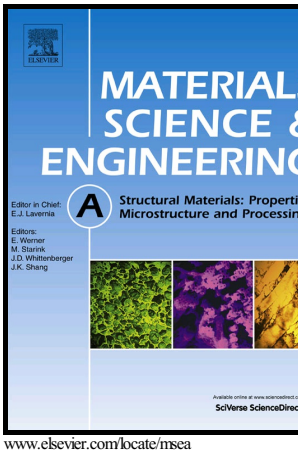

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Microstructural evolution and age hardening behavior of a new metastable beta Ti-2Al-9.2Mo-2Fe alloy

Cheng-Lin Li [a,*], Xu-Jun Mi [a], Wen-Jun Ye [a], Song-Xiao Hui [a], Dong-Geun Lee [b], Yong-Tai Lee [c]

[a] General Research Institute for Nonferrous Metals, Beijing, 100088, RP China

[b] Sunchon National University, Suncheon, 540-950, Korea

[c] Korea Institute of Materials Science, Changwon, 642-831, Korea

Corresponding Author:

Cheng-Lin Li

Email: chl211.lee@gmail.com

Address: General Research Institute for Nonferrous Metals, Beijing, 100088, RP China

Abstract

A study on microstructural evolution and age hardening behavior of a new metastable beta titanium alloy Ti-2Al-9.2Mo-2Fe was undertaken by microscopic observation, Vickers hardness and tensile tests in this research. The result showed that the athermal ω phase was formed in the beta matrix after solution treatment and followed by water quench, but it seemed that the athermal ω phase did not result in a considerable hardening (300 HV in hardness and 670 MPa in YS in ST condition). However, the isothermal ω phases with 10 ~ 40 nm and nano-scaled α platelets with 30 ~ 100 nm were observed in the alloy aged at lower temperatures (300 ~ 450 °C). The nano-scaled ω and α phase led to an attractive hardening effect (400 ~ 500 HV in hardness and above 1500 MPa in YS). However, micro-scaled α phase with 0.5 ~ 3 μm obtained in the samples aged at temperatures (500 ~ 600 °C) showed a moderate hardening (350 ~ 450 HV in hardness and 1100 ~ 1500 MPa in YS). The hardening went through an under-aging, peak-aging and over-aging due to the continuation of nucleation and growth of the α phases and subsequent coarsening. The coarsen α phases (3 ~ 5 μm) and grain boundary α layers (0.1 ~ 0.5 μm in thickness) obtained at high temperatures aging (650 ~ 750 °C) showed a poor hardening or even a softening (around 300 HV in hardness and below 1000 MPa in YS). The Ti-2Al-9.2Mo-2Fe