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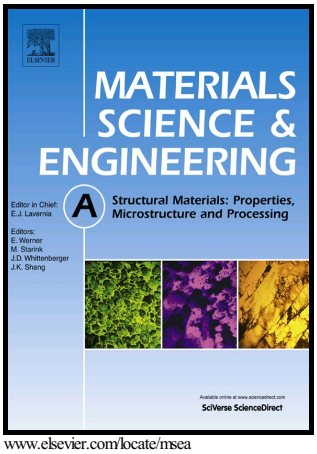

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PII: S0921-5093(17)31016-X
DOI: http://dx.doi.org/10.1016/j.msea.2017.08.009
Reference: MSA35357

To appear in: *Materials Science & Engineering A*

Received date: 31 May 2017
Revised date: 1 August 2017
Accepted date: 2 August 2017

Cite this article as: Xifeng Li, Nannan Chen, Jun Chen, Qiongfeng Mei, Li Wan Chunli Jia and He Liu, Superplastic deformation behavior of Ti-55 alloy withou and with 0.1wt%H addition, *Materials Science & Engineering A* http://dx.doi.org/10.1016/j.msea.2017.08.009

Superplastic deformation behavior of Ti-55 alloy without and with 0.1wt%H addition

Xifeng Li[a], Nannan Chen[a], Jun Chen[a,*], Qiongfeng Mei[a], Li Wan[b], Chunli Jia[b], He Liu[b]

[a] Department of Plasticity Technology, Shanghai Jiao Tong University, Shanghai 200030, China

[b] Capital Aerospace Machinery Company, Beijing 100076, China

*Corresponding author. J.Chen, Prof., Ph.D., Tel.: +86 21 62813432; Fax: +86 21 62826575

E-mail address: jun_chen@sjtu.edu.cn (J.Chen)

Abstract

The superplastic deformation behaviors of as-received Ti-55 alloy and hydrogenated alloy with 0.1wt%H were studied. The results indicate γ hydride readily decomposes and hydrogen easily escapes under vacuum or argon-protected condition near the starting temperature of α+β/β transformation. Compared with as-received alloy, the optimum superplastic temperature of hydrogenated alloy is reduced by about 125℃. Larger decrease of elongation in hydrogenated alloy appears if the deformation temperature and initial strain rate deviate from optimal ones. More proportion of β phase distributes uniformly around α phase grain boundaries and prominently inhabits the formation of voids in hydrogenated alloy during superplastic deformation. Hydrogen addition can lead to the improvement of discontinuous dynamic recrystallization mechanism and deformation compatibility of grain boundaries, as well as the reduction of dislocation pile-ups and tangles.

Keywords: Ti-55 alloy; hydrogenation; superplastic deformation behavior; dynamic recrystallization; dislocation; void

1. Introduction

Since hydrogen can be easily added and removed without melting, it is a unique alloying element in titanium alloys. Titanium alloys have a large affinity for hydrogen, which is capable of absorbing up to about 3.06wt% hydrogen at 600℃ and even higher contents at lower temperature[1, 2]. Actually, the existence of hydrogen in titanium alloys has two-sided functions. A great deal of attention has paid to strictly restricting the hydrogen content as hydrogen levels