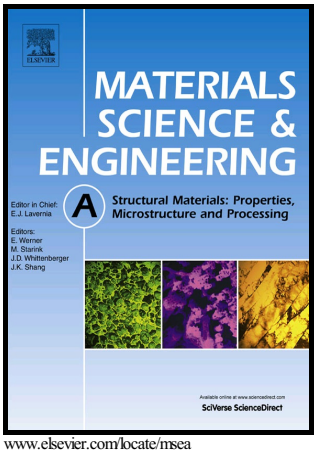
Effect of carbide precipitation on strain-hardening behavior and deformation mechanism of metastable austenitic stainless steel after repetitive cold rolling and reversion annealing

Y.M. He, Y.H. Wang, K. Guo, T.S. Wang



www.elsevier.com/locate/msea

PII: S0921-5093(17)31272-8
DOI: http://dx.doi.org/10.1016/j.msea.2017.09.103
Reference: MSA35570

To appear in: *Materials Science & Engineering A*

Received date: 10 September 2017
Revised date: 21 September 2017
Accepted date: 22 September 2017

Cite this article as: Y.M. He, Y.H. Wang, K. Guo and T.S. Wang, Effect of carbide precipitation on strain-hardening behavior and deformation mechanism of metastable austenitic stainless steel after repetitive cold rolling and reversion annealing, *Materials Science & Engineering A*, http://dx.doi.org/10.1016/j.msea.2017.09.103

Effect of carbide precipitation on strain-hardening behavior and deformation mechanism of metastable austenitic stainless steel after repetitive cold rolling and reversion annealing

Y.M. He[a], Y.H. Wang[a,b], K. Guo[a], T.S. Wang[a,b*]

[a]*State Key Laboratory of Metastable Materials Science and Technology, Yanshan University, Qinhuangdao 066004, China*

[b]*National Engineering Research Center for Equipment and Technology of Cold Strip Rolling, Yanshan University, Qinhuangdao 066004, China*

Abstract

A metastable austenitic stainless steel was repetitively cold rolled and reversely annealed. The strain-hardening behavior and deformation mechanism during tensile testing were comparatively studied for the specimens annealed at 800 °C and 1000 °C. Fine-grained austenite with uniformly distributed carbides was formed in the 800 °C-annealed specimen, whereas coarse-grained austenite without carbides was obtained with annealing at 1000 °C. Continuous strain hardening was achieved in all specimens, which could be attributed to the strain-induced martensite and deformation twining for the annealed specimens at 800 and 1000 °C, respectively. The carbide precipitation promoted the formation of strain-induced martensite due to the depletion of austenite stabilizers.

Keywords: Austenitic steel; Rolling; Annealing; Carbide precipitation; Strain hardening; Deformation mechanism.

1. Introduction

Grain refinement is a viable approach to improve the strength of engineering metals and alloys [1, 2]. Severe plastic deformation processes, such as equal channel angular pressing [3], high pressure torsion [4], accumulative roll bonding [5], multiple compression [6], and

* Corresponding author. Tel.: +86 335 8074631; fax: +86 335 8074545.
E-mail address: tswang@ysu.edu.cn (T.S. Wang).