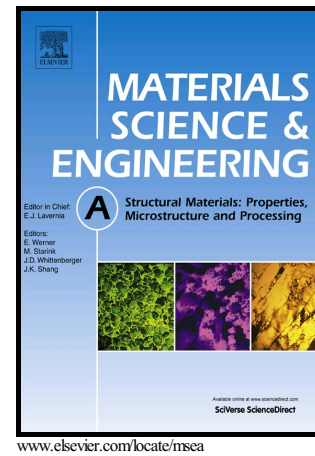


Author's Accepted Manuscript

Low-cycle fatigue behavior of pre-hardening
Hadfield steel

Chen Chen, Bo Lv, Fei Wang, Fucheng Zhang



PII: S0921-5093(17)30421-5
DOI: <http://dx.doi.org/10.1016/j.msea.2017.03.107>
Reference: MSA34890

To appear in: *Materials Science & Engineering A*

Received date: 12 December 2016
Revised date: 28 March 2017
Accepted date: 28 March 2017

Cite this article as: Chen Chen, Bo Lv, Fei Wang and Fucheng Zhang, Low-cycle fatigue behavior of pre-hardening Hadfield steel, *Materials Science & Engineering A*, <http://dx.doi.org/10.1016/j.msea.2017.03.107>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Low-cycle fatigue behavior of pre-hardening Hadfield steelChen Chen^a, Bo Lv^b, Fei Wang^a, Fucheng Zhang^{a, c,*}

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

^b College of Environmental and Chemical Engineering, Yanshan University, Qinhuangdao 066004, China

^c National Engineering Research Center for Equipment and Technology of Cold Strip Rolling, Yanshan University, Qinhuangdao 066004, China

Abstract: Low-cycle fatigue behaviors of the pre-hardening (PH) and the water-quenching (WQ) Hadfield steel were studied using optical microscopy, transmission electron microscopy, and electron backscatter diffraction technique. The effect of the PH treatment on low-cycle fatigue behavior of the Hadfield steel was analyzed through comparing the cyclic hardening/softening behaviors and the changing regulations of stress amplitude, internal stress, and effective stress at different total strain amplitudes. Results showed obvious differences in fatigue behaviors between the PH (with a cold rolling deformation degree of 40%) and the WQ Hadfield steels. Transient hardening followed by cyclic stability behavior occurred in the PH Hadfield steel under cyclic loading, whereas cyclic softening behavior was barely observed. The fatigue life of the PH Hadfield steel was higher than that of the WQ Hadfield steel at relatively low strain amplitudes, while a contrary result was obtained at relatively high strain amplitudes. At low strain amplitudes, the deformation twins induced in the PH Hadfield steel could enhance the multiplication and slip process of dislocations, which actually improved the deformation uniformity. The long-range motion of dislocations was intensified at high strain amplitudes. However, the dislocation motion was also blocked by twin boundaries. As a result, the interactions between dislocations and deformation twins enhanced, finally causing severe dislocation accumulation. These two effects of deformation twins on dislocation motion eventually resulted in different low-cycle fatigue behaviors of the PH Hadfield steel.

Key words: Hadfield steel; Pre-hardening; Low-cycle fatigue; Deformation twins; Dislocations

1 Introduction

Although Hadfield steel (Fe-12Mn-1.2C) possesses a good combination of high toughness and ductility with high work hardening capacity; however, the disadvantage of low primary

* Corresponding author, Tel.: +86 335 8063949; e-mail addresses: zfc@ysu.edu.cn (Fucheng Zhang)

Download English Version:

<https://daneshyari.com/en/article/5455710>

Download Persian Version:

<https://daneshyari.com/article/5455710>

[Daneshyari.com](https://daneshyari.com)