

Author's Accepted Manuscript

An experiment-based model of combined hardening and non-hardening embrittlement in an interstitial free steel

Yu Zhao, Shenhua Song



PII: S0921-5093(18)30272-7
DOI: <https://doi.org/10.1016/j.msea.2018.02.066>
Reference: MSA36153

To appear in: *Materials Science & Engineering A*

Received date: 14 November 2017
Revised date: 15 February 2018
Accepted date: 16 February 2018

Cite this article as: Yu Zhao and Shenhua Song, An experiment-based model of combined hardening and non-hardening embrittlement in an interstitial free steel, *Materials Science & Engineering A*, <https://doi.org/10.1016/j.msea.2018.02.066>

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.

An experiment-based model of combined hardening and non-hardening embrittlement in an interstitial free steel

Yu Zhao, Shenhua Song*

Shenzhen Key Laboratory of Advanced Materials, Shenzhen Graduate School, Harbin Institute of Technology, Shenzhen 518055, China

*Corresponding author. Tel.: +86-755-26033465; fax: +86-755-26033504;

shsong@hit.edu.cn; shsonguk@aliyun.com

Abstract

The fracture appearance transition temperatures (FATTs) are evaluated for the samples of a Nb-stabilized and P-strengthened interstitial free (IF) steel. Based on the measurements, the combined effect of hardening and phosphorus grain boundary segregation on the embrittlement of the steel is investigated. Both hardening and P boundary segregation can raise the FATT of the steel, causing hardening embrittlement and non-hardening embrittlement, respectively. Meanwhile, the grain size influences both kinds of embrittlement, i.e., there is a synergistic effect between grain size and hardening or P boundary segregation on the FATT of the steel. With the aid of the Taylor expansion along with the experimental data, a combined hardening and non-hardening embrittlement equation is established, being expressed as $FATT = 2.1C_p + 3.48\sigma_s - 22.36d^{1/2} + 0.64(C_p - 14)(d^{1/2} - 3.06) + 0.896(\sigma_s - 14)(d^{1/2} - 3.06) - 13.7$, where $FATT$ is the fracture appearance transition temperature in °C, C_p is the phosphorus boundary concentration in at.%, σ_s is the yield strength in 10MPa, and d is the grain size in mm. A comparison of the calculated and measured FATTs is made, demonstrating that the calculated FATTs are well consistent with the measured ones.

Keywords: Embrittlement; Grain boundaries; Segregation; Metals and alloys

Download English Version:

<https://daneshyari.com/en/article/7972901>

Download Persian Version:

<https://daneshyari.com/article/7972901>

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