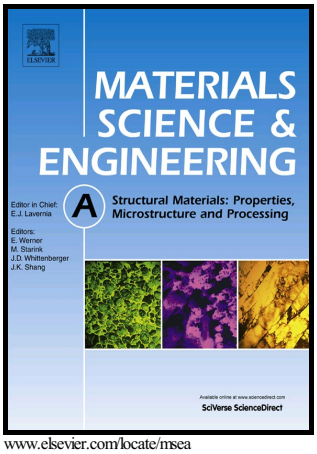
Low cycle fatigue behavior and microstructure evolution of a novel 9Cr–3W–3Co tempered martensitic steel at 650 °C

Hongyang Jing, Zhenxuan Luo, Lianyong Xu, Lei Zhao, Yongdian Han



www.elsevier.com/locate/msea

PII: S0921-5093(18)30866-9
DOI: https://doi.org/10.1016/j.msea.2018.06.071
Reference: MSA36626

To appear in: *Materials Science & Engineering A*

Received date: 28 April 2018
Revised date: 16 June 2018
Accepted date: 18 June 2018

Cite this article as: Hongyang Jing, Zhenxuan Luo, Lianyong Xu, Lei Zhao and Yongdian Han, Low cycle fatigue behavior and microstructure evolution of a novel 9Cr–3W–3Co tempered martensitic steel at 650 °C, *Materials Science & Engineering A,* https://doi.org/10.1016/j.msea.2018.06.071

Low cycle fatigue behavior and microstructure evolution of a novel 9Cr–3W–3Co tempered martensitic steel at 650 °C

Hongyang Jing[a,b], Zhenxuan Luo[a,b], Lianyong Xu[a,b,*], Lei Zhao[a,b], Yongdian Han[a,b]

[a]School of Materials Science and Engineering, Tianjin University, Tianjin 300072, China;

[b]Tianjin Key Laboratory of Advanced Joining Technology, Tianjin 300072, China.

*Corresponding author. Tel./fax: +86 22 27402439. xulianyong@tju.edu.cn.

Abstract

A series of uniaxial strain-controlled fatigue tests were performed at 650 °C to explore the high-temperature low cycle fatigue (LCF) behavior and corresponding microstructure evolution of a novel 9Cr–3W–3Co martensitic G115 steel. The fatigue test results showed that the steel exhibited a cyclic softening behavior and the degree of softening S increased with the total strain amplitude, which was related to the decrease of dislocation density and subgrain development. Further, statistical analysis of the subgrain size after LCF tests at different strain amplitudes showed that the development of subgrain or cell depended on both the plastic strain level and cycles, among which the effect of plastic strain level is dominant. The variation of degree of softening ΔS was used to make comparison between G115 steel and P92 steels to evaluate the effects of the strain amplitudes on the respective S. The G115 steel experienced the minimum relative increment compared with P92 steel. This resulted from the strengthening by fresh and fine Cu-rich precipitates. The number density of Cu-rich particles increased with the total strain amplitude and that weakened the effect of strain amplitude on degree of softening. SEM was employed to investigate the fracture morphology; representative images of the G115 steel after the LCF tests