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Naiqiang Zhang, Zhongliang Zhu, Guoqiang Yue, Dongfang Jiang, Hong Xu

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The oxidation behaviour of an austenitic steel in deaerated supercritical water at 600 - 700 °C

Naiqiang Zhang [a], Zhongliang Zhu [a], Guoqiang Yue [a], Dongfang Jiang [a], Hong Xu* [a]

[a] Key Laboratory of Condition Monitoring and Control for Power Plant Equipment of Ministry of Education, North China Electric Power University, Beijing 102206, PR China

*Corresponding author: Tel./ Fax: +86 10 61773877 (H. Xu)

E-mail Addresses. xuhong@ncepu.edu.cn (H. Xu)

Abstract: Oxidation tests were conducted on austenitic steel exposed to deaerated supercritical water at 600 - 700 °C and 25 MPa. The oxidation kinetics followed between a linear law and a parabolic law at 600 - 650 °C while followed a near-parabolic law at 700 °C. A double oxide layer, which consists of a Fe-rich outer layer and a Cr-rich inner layer, was formed on the steel. The outer layer consists of Fe_3O_4 at 600 - 620 °C for 1000 h and at 650 - 700 °C for 400 h, while the inner layer consists of spinel in all cases. Fe_2O_3 is formed at 650 °C for 1000 h and at 700 °C for 600 h. Exfoliations were observed at 700 °C. The formation and spallation mechanism of oxides are also discussed.

Keywords: Austenitic Steel; Oxidation; Supercritical water; Temperature; Microstructure; Exfoliation.

1. Introduction

There is an impending need to increase the efficiency of power plants and reduce pollutant emissions. The efficiency of conventional coal-fired power plant is closely related to the steam temperature and pressure. An increase in efficiency can be achieved by increasing the steam temperature and pressure [1]. However, under