Effect of heat treatment on the tribocorrosion behavior of 20Cr13 martensitic stainless steel

Yining Zhou[1,2], Zhichao Zhao[3], Shengli Jiang[1,2,*], Deli Duan[2,3,**]

[1]*CAS Key Laboratory of Nuclear Materials and Safety Assessment, Institute of Metal Research, Chinese Academy of Sciences, Shenyang 110016, China*
[2]*School of Materials Science and Engineering, University of Science and Technology of China, Hefei 230026, China*
[3]*Shi-Changxu Innovation Center for Advanced Materials, Institute of Metal Research, Chinese Academy of Sciences, Shenyang 110016, China*

ynzhou21s@imr.ac.cn

Abstract In this study, we investigated the tribocorrosion behavior of 20Cr13 martensitic stainless steel subjected to different heat treatments. After the annealed 20Cr13 quenching at 1000 ℃, the steel was tempered at 250 ℃ and 650 ℃, resulting in two unique microstructures. These conditions, along with the annealed state, were examined for their tribocorrosion performance in a 3.5% NaCl solution. This study focused on the effects of applied load and microstructural changes on tribocorrosion characteristics. Experimental findings revealed that the opencircuit potential of the samples decreased with increasing load, and then keep the same, while the corrosion current density increased, it indicated that the corrosion mechanism changes with increasing load. And as the load increases, the effect of corrosion on wear decreases to negative values, this indicated that corrosion influences wear in different ways: it accelerates wear by attacking the sample surface, and the formation of a tribocorrosion layer acts as a lubricant, reducing wear, especially under high loads. Among the tested conditions, different tempering temperatures influence the precipitation of carbide, and then change the lattice distortion of the matrix and the proportion of the cathode phase, and ultimately affect the corrosion resistance and mechanical properties of the sample, the steel tempered at the lower temperature exhibited superior corrosion resistance and deformation resistance but showed less effective tribocorrosion resistance under low load conditions. This paper presents a quantitative analysis of material loss attributed to various factors, offering insights into the complex interactions at play in tribocorrosion processes.

Keywords 20Cr13; Microstructure; Tribocorrosion; Load; NaCl solution

Reference

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