Accepted Manuscript

Title: Effect of time on the characteristics of passive film formed on stainless steel

Author: Ruijing Jiang Yuwu Wang Xu Wen Changfeng Chen Jingmao Zhao

PII: S0169-4332(17)30836-X
DOI: http://dx.doi.org/doi:10.1016/j.apsusc.2017.03.155
Reference: APSUSC 35531

To appear in: *APSUSC*

Received date: 29-9-2016
Revised date: 22-2-2017
Accepted date: 17-3-2017

Please cite this article as: R. Jiang, Y. Wang, X. Wen, C. Chen, J. Zhao, Effect of time on the characteristics of passive film formed on stainless steel, *Applied Surface Science* (2017), http://dx.doi.org/10.1016/j.apsusc.2017.03.155

Effect of time on the characteristics of passive film formed on stainless steel

Ruijing Jiang[a,b,*], Yuwu Wang[a], Xu Wen[c], Changfeng Chen[c] Jingmao Zhao[a,b]

[a]*College of Materials Science and Engineering, Beijing University of Chemical Technology, Beijing 100029, China*

[b]*Beijing Key Laboratory of Electrochemical Process and Technology for Materials, Beijing University of Chemical Technology, Beijing, 100029, PR China*

[c]*Department of Materials Science and Engineering, China University of Petroleum (Beijing), Beijing 102249, P.R.China*

Abstract: By potentiostatic polarization for different time, passive films were formed on AISI 316SS. Characteristics of these films were studied using electrochemical measurement and surface analysis method. The results show the film thickness, film resistance and carriers' density in the film all increase with time, and the increase of the film thickness and resistance both follows the direct logarithmic law. As time prolongs, FeOOH penetrates deep into the film, and its concentration in the film also increases, while the distribution of the other components of the film changes a little. The changing mechanisms of passive film characteristics with time were analysed.

Keywords: Passive films; Time; EIS; XPS; Potentiostatic; Capacitance measurement.

1 Introduction

As a kind of stainless steel, AISI 316SS is widely used in industry or in our daily life. It can be used in seawater, chemical facilities, medical equipment, stents implanted in a human body, etc. The diverse applications of AISI 316SS are attributed to the passive film formed on the steel surface which can prevent the steel from corrosion. As a result, the passive film has been the research project of many researchers in the past decade [1-4].

Once the stainless steels contact with the service environments, it needs a period to form a passive film on the steel surface. In this period, the film will grow continuously until a steady state achieves [5-7]. Thus the growth of the passive film is a time-dependent event. Many authors have discussed the effect of time on properties of passive films. For instance, L. Freire et al. [8] studied the variation of film resistance of AISI 316 with the immersion time in alkaline solutions. T. Nickchi et al. [9] researched the change of film resistance of Alloy 800 with the immersion time in the presence of hydrogen peroxide. B. Krishnamurthy et al. [10] discussed the effect of electric field strength on the time-dependent passive behaviour of metals.

* Corresponding author. Tel.: +86 10 89733200; fax: +86 10 89733200.
E-mail addresses: jrjyt@163.com.