

前一个

后一个

本期目录 | 下期目录 | 过刊浏览 | 高级检索

[打印本页] [关闭]

研究报告

2205双相不锈钢与316L奥氏体不锈钢钝化膜内点缺陷扩散系数的计算分析

刘佐嘉¹,程学群¹,刘小辉²,李晓刚¹

1. 北京科技大学腐蚀与防护中心 北京 100083
2. 中国石油化工股份有限公司青岛安全工程研究院 青岛 266071

摘要:

应用电容测试法并借助于点缺陷模型(PDM)计算了2205双相不锈钢与316L奥氏体不锈钢在NaCl溶液中所形成的钝化膜内点缺陷的扩散系数,利用实验测得钝化膜的稳态电流和PDM模型对计算结果进行了验证分析。通过两种计算方法得到点缺陷在2205双相不锈钢与316L奥氏体不锈钢钝化膜内的扩散系数约为 $10^{-23}\text{cm}^2/\text{s}\sim 10^{-20}\text{cm}^2/\text{s}$ 数量级,并发现在模拟海水溶液中2205钢的扩散系数比316L钢小,氧空位所形成的点缺陷在2205钢的钝化膜内比316L钢扩散困难,从而使得2205不锈钢的钝化膜比316L不锈钢更加致密与完整,保护性能更好。

关键词: 扩散系数 点缺陷模型 钝化膜 电容测试法 稳态电流密度

CALCULATION AND ANALYSIS OF DIFFUSIVITY OF POINT DEFECTS IN PASSIVE FILM FORMED ON 2205 DUPLEX STAINLESS STEEL AND 316L AUSTENITIC STAINLESS STEEL

LIU Zuojia¹, CHENG Xuequn¹, LIU Xiaohui², LI Xiaogang¹

1. Corrosion and Protection Centre, University of Science and Technology Beijing, Beijing 100083
2. Safety & Engineering Academy of SINOPEC, Qingdao 266071

Abstract:

The diffusivity of point defects in the passive film formed on 2205 duplex stainless steel and 316L stainless steel in NaCl solution was calculated by means of capacitance measurement and PDM (point defect model). The calculated result was testified and analyzed by experimental steady current density of passive film and PDM. It is showed that the order of magnitude of diffusivity is about $10^{-23}\text{cm}^2/\text{s}\sim 10^{-20}\text{cm}^2/\text{s}$, and the diffusivity of 2205 DSS is less than 316L SS in simulated ocean solution. It is concluded that the diffusion of point defect which is caused by oxygen vacancy in 2205 DSS is harder than 316L SS, so in contrast to 316L SS, the passive film of 2205 DSS is much densified and compact with completeness and excellent protection.

Keywords: diffusivity point defect model passive film capacitance measurement steady current density

收稿日期 2009-06-29 修回日期 2009-10-19 网络版发布日期 2010-08-13

DOI:

基金项目:

国家自然科学基金项目(50871020)资助

通讯作者: 刘佐嘉

作者简介: 刘佐嘉,男,1985年生,硕士生,研究方向为金属腐蚀与防护

通讯作者E-mail: lzandj@yahoo.com.cn

扩展功能

本文信息

- Supporting info
- PDF(1642KB)
- [HTML] 下载
- 参考文献[PDF]
- 参考文献

服务与反馈

- 把本文推荐给朋友
- 加入我的书架
- 加入引用管理器
- 引用本文
- Email Alert
- 文章反馈
- 浏览反馈信息

本文关键词相关文章

- 扩散系数
- 点缺陷模型
- 钝化膜
- 电容测试法
- 稳态电流密度

本文作者相关文章

- 刘佐嘉
- 程学群
- 李晓刚
- 刘小辉

PubMed

- Article by Liu,Z.J
- Article by Cheng,H.Q.
- Article by Li,X.G
- Article by Liu,X.H

参考文献:

- [1] Zeng R C, Han E H. Corrosion and Protection of Materials [M]. Beijing: Chemical Industry Press, 2006: 144\par}
- [2] (曾荣昌, 韩恩厚. 材料的腐蚀与防护 [M]. 北京: 化学工业出版社, 2006: 144)
- [3] Zeng Y M, Luo J L. Electronic band structure of passive film on X70 pipeline steel [J]. Electrochim. Acta, 2003, 48:3551-3562 [crossref](#)
- [4] Sikora E, Macdonald D D. Nature of the passive film on nickel [J]. Electrochim. Acta, 2002, 48(1):69-77 [crossref](#)
- [5] Li D G, Feng Y R, Bai Z Q, et al. Calculation of diffusivity of point defects in passive film formed on X80 pipeline steel [J]. Chin. J. Appl.Chem., 2008, 25(9): 1007-1010
(李党国, 冯耀荣, 白真权等. X80管线钢钝化膜内点缺陷扩散系数的计算 [J]. 应用化学, 2008, 25(9): 1007-1010)
- [6] Elzbieta S, Janusz S, MacDonald D D. A new method for estimating the diffusivities of vacancies in passive film [J]. Electrochim. Acta, 1996, 41(6):783-789 [crossref](#)
- [7] Cheng Y F, Yang C, Luo J L. Determination of the diffusivities of point defects in passive films on carbon steel [J]. Thin Solid Film, 2002, 416:169-173 [crossref](#)
- [8] Ahn S J, Kwon H S. Diffusivity of point defects in the passive film on Fe [J]. Electroanal. Chem, 2005, 579:311-319 [crossref](#)
- [9] Buchler M, Schmuki P, Bohni H. A light reflectance technique for thickness measurement of passive films [J]. Electrochim. Acta, 1997, 43(5-6):635-637 [crossref](#)
- [10] Horowitz G. Capacitance-voltage measurements and flat-band potential determination on Zr-doped α - Fe_2O_3 single-crystal electrodes [J]. Electroanal. Chem, 1983, 159:421-436 [crossref](#)
- [11] Bellucci F, Nicodemo L, Monetta T, et al. A study of corrosion initiation on polyimide coatings [J]. Corros.Sci, 1992, 33(8):1203-1226 [crossref](#)
- [12] Li J B, Zheng M S, Zhu J W. Semiconductive properties of passive film formed on 304L stainless steel [J]. Corros. Sci. Prot. Technol., 2006, 18(5): 348-352
- [13] 李金波, 郑茂盛, 朱杰武. 304L不锈钢钝化膜半导体性能研究 [J]. 腐蚀科学与防护技术, 2006, 18(5):348-352 [浏览](#)
- [14] Cheng X Q, Li X G, Du C W. Passive film formed and semiconductive properties of 316L and 2205 stainless steel in acetic acid solution [J]. Chin. Sci. Bull, 2009, 54(1):104-109 [crossref](#)
- [15] (程学群, 李晓刚, 杜翠薇. 316L和2205不锈钢在醋酸溶液中钝化膜的生长及其半导体属性研究 [J]. 科学通报, 2009, 54(1): 104-109)

本刊中的类似文章

1. 张义 孟国哲 邵亚薇 张涛 王福会. 高密度纳米孪晶镍镀层的电化学腐蚀行为 [J]. 中国腐蚀与防护学报, 2009, 29(2): 99-103
2. 李金波 左剑恶. 温度对X80管线钢钝化膜电化学性能的影响 [J]. 中国腐蚀与防护学报, 2009, 29(1): 40-43