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研究论文

Ca²⁺和臭氧对A3碳钢表面磷化膜的影响

盛敏奇¹; 王毅^{1;2}; 钟庆东¹; 林海¹; 周琼宇¹; 卫银银³

1.上海大学 上海市现代冶金与材料制备重点实验室 上海 200072

2.上海电力学院 能源与环境工程学院 上海 200090

3.华东师范大学化学系 上海 200062

摘要:

在低温磷化条件下,在磷化液中加入Ca²⁺并以臭氧作为促进剂,在A3碳钢表面制备了磷化膜。通过SEM、XRD、EDS、FT-IR以及腐蚀电化学测试等手段对磷化膜进行表征,研究了Ca²⁺和臭氧对磷化膜的结构和性能的影响。结果表明,在磷化液中添加Ca²⁺所得磷化膜的质量随着Ca²⁺浓度的提高而减小,添加Ca²⁺可细化磷化膜的晶粒、提高磷化膜的致密度和耐蚀性能;溶解在磷化液中的臭氧具有细化磷化膜晶粒和促进晶粒生长的作用,能大幅提高磷化膜晶粒的形核率和磷化膜的主体形成速度。当磷化液的pH=2.70、Ca²⁺浓度为1.8 g/L、臭氧含量为2.50 mg/L时,磷化膜的质量为5.46 g/m²,其耐硫酸铜点滴腐蚀时间超过122 s,在5% NaCl溶液中的腐蚀电流为0.50 μA/cm²。

关键词: 材料表面与界面 磷化 A3碳钢 臭氧 钙离子 腐蚀 表面处理

Influence of Ca²⁺ and Dissolved Ozone in Phosphating Solution on Phosphate Coating on A3 Carbon Steel

SHENG Minqi¹; WANG Yi^{1;2}; ZHONG Qingdong¹; LIN Hai¹; ZHOU Qiongyu¹; WEI Yinyin³

1.Shanghai Key Laboratory of Modern Metallurgy and Material Processing; Shanghai University; Shanghai 200072

2.School of Energy Sources and Environment Engineering; Shanghai University of Electric Power; Shanghai 200090

3.Department of Chemistry; East China Normal University; Shanghai 200062

Abstract:

Phosphate coating on the surface of A3 carbon steel was prepared through the addition of Ca²⁺ and ozone as an accelerator of phosphating treatment at low temperature, and was characterized by SEM, XRD, EDS, FT-IR and corrosion electrochemical testing. The effects of Ca²⁺ and dissolved ozone in phosphating solution on the structure and performance of phosphate coating were investigated. The results show that the coating mass decreases with increasing the Ca²⁺ concentration in phosphating solution. Ca²⁺ can reduce the crystal size of coating and increase the density and corrosion resistance of coating. The dissolved ozone in phosphating solution can reduce the crystal size of coating and promote the growth of crystal, so the nucleation and formation rates are increased and the corrosion resistance of coating is improved. When pH=2.70, concentration of Ca²⁺ and ozone were 1.8 g/L and 2.50 mg/L respectively, the mass of phosphate coating was 5.46 g/m², the corrosion-resistance time of coating with CuSO₄ dripping was >122 s, and the corrosion current of phosphating sample was 0.50 μA/cm² in 5% NaCl solution.

Keywords: surface and interface in the materials phosphating A3 carbon steel ozone calcium ion corrosion surface treatment

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通讯作者: 盛敏奇

作者简介:

通讯作者E-mail: smqtg@yahoo.com.cn

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