

论文

低碳钢在海水中的阴极电化学行为

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摘要:

采用电化学技术结合XRD分析, 研究了A3碳钢在海水中的阴极电化学行为, 探讨了锈层在阴极过程中的作用. 碳钢表面生成的锈层由内锈层和外锈层组成, 内锈层主要组成相为 γ -FeOOH, α -FeOOH, β -FeOOH以及 Fe_3O_4 与 γ - Fe_2O_3 的混合物. 浸泡126 d时, 外锈层主要由 γ -FeOOH组成; 浸泡364 d由 γ -FeOOH, α -FeOOH, Fe_3O_4 和 γ - Fe_2O_3 组成. 不同锈层在阴极过程中所起的作用不同. 外锈层主要作用是阻碍溶解氧到达金属表面, 内锈层除此之外还可以参与还原反应, 加速阴极反应. 提出了一个评价锈层参与还原反应程度的参数 α , 在浸泡不同时期锈层参与还原反应的比例不同, 浸泡前7 d, α 值上升比较明显, 随后增加比较缓慢, 浸泡168 d后基本稳定. 探讨了内、外锈层组分的变化以及锈层各组分的相互作用.

关键词: 低碳钢 海水腐蚀 锈层 电化学阻抗谱 极化曲线

CATHODIC ELECTROCHEMICAL BEHAVIORS OF MILD STEEL IN SEAWATER

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Abstract:

The cathodic electrochemical behavior of A3 mild steel in seawater was studied and the roles of the formed rust layers in cathodic process were analyzed by means of electrochemical tests and XRD. The results showed that the rust formed could be classified into outer layer and inner layer. The inner layer is mainly composed of γ -FeOOH, α -FeOOH, β -FeOOH and $\text{Fe}_3\text{O}_4/\gamma$ - Fe_2O_3 , while the main phases in the outer layer changed with the increase of immersion time. During the initial immersion period of 126 d, the phase is γ -FeOOH, but after about 364 d immersion, the phases are γ -FeOOH, α -FeOOH and $\text{Fe}_3\text{O}_4/\gamma$ - Fe_2O_3 . These rust layers play different roles in the cathodic process. Both the outer and inner rust layers can prevent the dissolved oxygen from diffusing into the steel substrate, while the inner layer could also participate in reduction reaction which accelerated the cathodic reaction. A parameter α was induced to evaluate the participation degree of rust in the reduction reaction. The value of parameter α obviously increased during the first 7 d immersion, and almost didn't change after 168 d immersion. Changes of components in outer and inner layers were discussed and the interactions of different components were analyzed.

Keywords: mild steel corrosion in seawater rust layer electrochemical impedance spectrum (EIS) polarization curve

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