Electrochemical Behavior of 2205 Duplex Stainless Steel in a Chloride-Thiosulfate Environment

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The electrochemical behavior of 2205 duplex stainless steel in chloride-thiosulfate environment was investigated by various methods: potentiodynamic polarization, electrochemical impedance spectroscopy (EIS), and Mott-Schottky measurements. The chemical composition of the passive films was analyzed by X-ray photoelectron spectroscopy (XPS). The composition of the gases produced during the corrosion process was detected by a mass spectrometer. The results indicated that $S_2O_3^{2-}$ had a synergistic and detrimental effect on passive film breakdown and made it easier for Cl^- to initiate pitting by reducing to hydrogen sulfide which catalyzed the anodic dissolution. The selective dissolution of the ferrite phase was investigated on 2205 duplex stainless steel. The Cl^- and $S_2O_3^{2-}$ slightly deteriorated the passive films in the passive region at high anodic potentials, and $S_2O_3^{2-}$ facilitated the oxidation of Cr(III) to Cr(VI). The capacitance and XPS results revealed that the oxide films on 2205 duplex stainless steel consisted mainly of Cr oxide and Fe oxide, and in different passive regions, they exhibit different electrochemical and semiconductor properties.

Keywords: 2205 duplex stainless steel, electrochemical behavior, chloride-thiosulfate, passive film.

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