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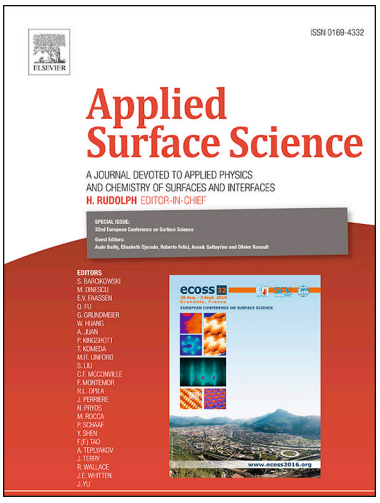

Full Length Article

Combined effect of pH and H_2S on the structure of passive film formed on Type 316L stainless steel

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Combined effect of pH and H_2S on the structure of passive film formed on Type 316L stainless steel

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Abstract

The effect of pH on the structure and protectiveness of passive films formed in H_2S-containing environment was investigated using potentiodynamic polarization, X-ray photoelectron spectroscopy (XPS) and time of flight secondary ion mass spectrometry (ToF-SIMS). The corrosion resistance of 316L stainless steel decreased with pH under H_2S-containing condition. The passive films formed at higher pH contained lower content of Cr and higher content of S. This was responsible for the passive film degradation. Ni was enriched at the film/metal interface, while Cr was enriched in the passive film. The content of NiO in the passive film increased with pH, which resulted in the weakened Ni enrichment at the film/metal interface at higher pH. The results also indicated that H_2S and pH had a combined effect on the passive film structure. The oxide films presented a three-layer structure, where the outermost layer was mainly composed of hydroxides, and the intermediate and inner layers were dominated by sulfides and oxides. The presence of H_2S could inhibit the formation of iron oxides. Therefore, iron oxides and iron sulfides were enriched in the inner and intermediate layer, respectively.

Keywords: Stainless steel; SIMS; Polarization; XPS; Passive films