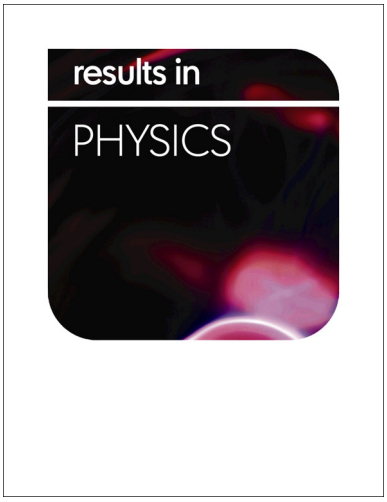

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Effect of heat treatment processes on the localized corrosion resistance of austenitic stainless steel type 301 in chloride/sulphate solution

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Abstract

The effect of quenching and annealing heat treatment on the localized corrosion resistance of 301 austenitic steel in 2M H_2SO_4/0.75% - 2.25% NaCl was studied by potentiodynamic polarization, open circuit potential measurement and optical microscopy analysis. The corrosion rate of the quenched, annealed and untreated steel increased with increase in NaCl concentration. The quenched steel had the lowest corrosion rate values, followed by the annealed steel. Variation in Cl^- ion concentration had no significant effect on the pitting corrosion resistance and passivation behavior of the quenched steel, though increase in current density at breakdown potential was observed at higher Cl^- ion concentration. The untreated steel experienced significant reduction and collapse of it passive film after 1.5% NaCl. Delayed passivation occurred on the annealed steel following metastable pitting lead to short passivation range. Open circuit potential measurement showed large cathodic shift of the corrosion potential for the quenched steel, compared to the anodic shift for the untreated steel. Optical microscopic images showed a deteriorated morphology and the presence of different phases for the untreated 301SS. Intergranular cracks were observed on the annealed and quenched 301SS while corrosion pits was observed on the annealed 301SS.

Keywords: corrosion; pitting; chloride; steel

Introduction

Austenitic stainless steels represent about 60% of the world's total stainless steel production [1]. They display properties such as good corrosion resistance, high strength, toughness, good