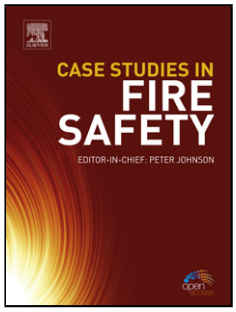

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Effect of composition and microstructure of duplex stainless steel on adsorption behaviour and efficiency of corrosion inhibitors in 4 molar hydrochloric acid. Part I: standard DSS 2205

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Highlights

- Variation in the elemental composition on different batches of the same duplex stainless steel 2205 results in different uninhibited and inhibited corrosion rate.
- The higher the Ni content, Ni/Cr ratio or austenite content, the lower is the weight loss.
- The use of higher inhibitor dosage (20mM) eliminates such dependence of weight loss on variation in the elemental compositions
- The cationic inhibitor preferentially adsorbs on the ferrite phase (the carbon concentration on the ferrite phase is around three time that on the austenite phase measured by SEM-EDX).

ABSTRACT

We investigate relationships between the elemental composition and microstructure of DSS 2205 materials and their acid corrosion behaviour (4M HCl) in the absence and presence of inhibitor (naphthylmethyl quinolinium chloride, NMQCl). Without inhibitor, the corrosion rate decreases with increasing Ni and austenite content. The austenite content is mainly controlled by Ni and N contents. In the presence of inhibitor, at concentrations 4–11.1 mM, the corrosion rate decreases with increasing Ni content and inhibition efficiencies are 94.5–99%. When the inhibitor dosage is 20 mM, the corrosion rate becomes independent of Ni content and inhibition efficiencies are ≥99%.

1 Introduction

Duplex stainless steels (DSSs) have a heterogeneous microstructure mainly composed of austenite (face-centred-cubic, γ-phase) and ferrite (body-centred-cubic, α-phase). The concentration of these major phases is controlled by chemical