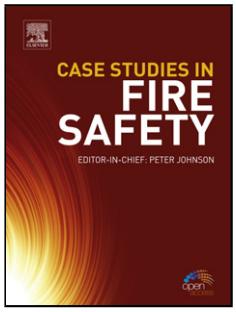

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Authors: Xing Qi, Honghuan Mao, Yitao Yang

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Corrosion behavior of nitrogen alloyed martensitic stainless steel in chloride containing solutions

Xing Qi[a], Honghuan Mao[a], Yitao Yang[a, *].

[a] School of materials science and engineering, Shanghai University, Shanghai 200072,China

Highlights:

- Nitrogen bearing experimental steels possess more superior corrosion resistance.
- An optimum range of nitrogen contents is discovered
- Nitrogen and carbides are the main factors influencing the corrosion properties.
- An underlying mechanism for evolution of corrosion behavior is proposed.

ABSTRACT:

Influence of nitrogen alloying on corrosion resistance of martensitic stainless steels (MSSs) with different nitrogen contents was investigated by immersion corrosion measurement and electrochemical measurement in chloride medium. It was observed that the nitrogen bearing MSSs exhibit more superior corrosion resistance, and an optimum range of nitrogen content between 0.04-0.05 wt % was found. The degradation of corrosion properties happened in higher nitrogen bearing samples is attributed to the occurrence of more concentrated Cr-depleted zones resulted from massive Cr-rich $M_{23}C_6$ carbides precipitation, although nitrogen addition is believed to be able to improve the corrosion resistance of MSSs effectively.

Keywords: A. Stainless steels, B. EIS, B. Polarization C. Passive films, C. Pitting corrosion

1. Introduction

Owing to the preferable combination of mechanical properties and corrosion resistance, conventional martensitic stainless steels (MSSs) are widely applied in many industries such as machinery manufacturing, medical equipment and aerospace, etc[1-3]. However, MSSs are not as good as austenitic stainless steel, it is lacking in localized corrosion resistance in some specific environments, and is especially sensitive to pitting corrosion when such anionic species as chloride ion is in presence[4]. In order to meet the continuous growth of usage requirements, it is significant to improve the critical performance of MSSs. Since nitrogen as an alloying element in iron-based alloys was found in last century, nitrogen bearing steels have attracted increasing attention, and the effects of nitrogen addition on different properties of stainless steels were profoundly investigated during the several decades[5-7]. It is well documented in many publications [8-10] that nitrogen could promote the improvement of the microstructure evolution, which consequently leads to the