Influence mechanism of heat treatment on corrosion resistance of Te-containing 15-5PH stainless steel

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Abstract In this study, the corrosion resistance mechanism of the Te and heat treatments on martensitic stainless steel (15-5PH steel) was investigated. Heat treatment affected the dislocation density of the Te-containing 15-5PH steel and reduced its corrosion tendency. Electrochemical dissolution of the MnS-Te inclusions induced pitting corrosion. Heat treatment significantly affects the potential difference between the Te-modified inclusions and the steel matrix, consequently influencing the emergence of pitting corrosion. Heat treatment improved the anti-corrosion properties of 15-5PH steel by transforming it from an active state to a passive state. The Mott-Schottky test results show that the passive film always exhibits n-type semiconductor characteristics and that the defect density of the passive film is reduced by the heat treatment. Heat treatment facilitated the enrichment of Cr, Te, and TeO_3 in the passivation film, resulting in its improved stability and corrosion resistance. The formation of an insoluble or slowly dissolved tellurite film through Te anodic oxidation, along with the self-healing properties of TeO_3, improved the repassivation capability of the passivation film of the steel.

Keywords: Stainless steel; Te treatment; Inclusion; Passive films; Pitting corrosion.

Reference:

[1] S. Yang, Z. Che, W. Liu, Z. Liu, X.Cheng, C. Liu, X. Li, Influence mechanism of heat treatment on corrosion resistance of Te-containing 15–5PH stainless steel, Corrosion Science, 225 (2023) 111610-111610.