Corrosion Fatigue Crack Growth Inhibition Of Duplex Stainless Steel

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Summary

The main objective of this study is to examine the inhibition effect of chromate on corrosion fatigue crack growth in a super duplex stainless steel alloy. Corrosion fatigue crack propagation tests were performed for Zeron 100 in air, 3.5% NaCl, and in 3.5% NaCl inhibited with sodium chromate (Na2CrO4) using two chromate concentrations. Specimens were tested in the TL orientation. Results show that crack growth rates are enhanced in 3.5% NaCl solution relative to air over the entire range of DeltaK tested. Addition of 0.02 M Na2CrO4 to 3.5% NaCl solution results in notable decreases in crack growth rates up to a specific value of DeltaK above which crack growth rates approach values measured in pure 3.5% NaCl solution. When the chromate concentration is increased by ten fold, corrosion fatigue crack growth rates are markedly reduced and approach measurements obtained in air for the entire range of DeltaK. Examination of fracture surfaces by the scanning electron microscope reveals the presence of ductile striations in austenite and brittle striations in ferrite. The basic striations characteristics in the austenitic phase are apparently the same in all the environments . However, ferrite striations appear to be DeltaK and environment dependent. Scratch tests were carried out to examine the effect of chromate concentration on repassivation kinetics of the duplex alloy. Chromate inhibition effectiveness during corrosion fatigue of duplex stainless steel is proposed to correlate win chromate repassivation. kinetics and the crack tip strain rate.

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