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Effect of Traces of Dissolved Oxygen on the Passivation Stability of Super 13Cr Stainless Steel Under High CO_2/H_2S Conditions

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Despite being widely used under a variety of oxygen-free conditions, super 13Cr stainless steel (13% Cr) may suffer serious failure in the presence of traces of oxygen. However, very little attention has been paid to the effect of traces of dissolved oxygen (DO, ppb levels) on the corrosion resistance of stainless steels. We used the potential of electrochemical characterization techniques (e.g., cyclic polarization and surface analysis) to study the effect of traces of DO (10–1000 ppb) on the stability of the passive film generated on super 13Cr stainless steel under high CO_2/H_2S conditions (typical of oil and gas production). DO was demonstrated to accelerate both the anodic and cathodic processes. The sensitive DO levels at varying conditions were determined by conducting electrochemical experiments under different concentrations of DO. The results showed that the passive current density increased with the concentration of DO in CO_2/H_2S solutions. The stability of the passive film decreased with the concentration of DO.

Keywords: super 13Cr; oxygen corrosion; critical dissolved oxygen levels; passive film.

FULL TEXT