Effect of Alternating Stray Current and Stress on the Corrosion Behavior of X80 Pipeline Steel in Soil Simulated Solution

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The corrosion behavior of X80 pipeline steel in 3.5 wt.% NaCl solution and simulated Dagang soil solution under different alternating current (AC) electrical densities was studied using the weight loss method, and was tested and analyzed using the electrochemical test technique and surface analysis technique, such as open circuit potential (OCP), polarization curve and scanning electron microscopy (SEM). The results showed that the corrosion potential of X80 pipeline steel was negative under the coupling of AC and stress. With the increase of AC stray current density, the negative shifted rate of corrosion potential increased, which indicated that the electrochemical corrosion behavior of X80 pipeline steel aggravated due to the coupling of AC stray and stress. In addition, the coupling of AC stray current and stress affected the corrosion process of X80 pipeline steel, which did not show any tendency of passivation in the experimental. Under the action of the alternating stray current, the reduction reaction of H₂ and O₂ occurred in X80 pipeline steel in the solutions of 3.5% NaCl and Dagang soil. When the applied stress was kept constant, the corrosion morphology of X80 pipeline steel samples underwent uniform corrosion under low AC stray current density (0 - 100 A/m²), whereas the corrosion morphology of X80 pipeline steel samples showed that the pitting corrosion occurred under the action of high AC stray current density (100 - 300 A/m²).

Keywords: X80 pipeline steel; alternating stray current; stress; corrosion potential; corrosion morphology

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