Effects of Alternating Current on Corrosion Behavior of X100 Pipeline Steel in Simulated Soil Solution

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Electrochemical measurements, immersion tests, and surface analysis technology were used to study the effects that alternating current (AC) has on the corrosion behavior of X100 pipeline steel in simulated alkaline and acidic soil solutions. In the both simulated soil solutions, the AC corrosion rates of X100 pipeline steel increased with an increase in the applied AC current density, but the increase in the rate of corrosion rates gradually decreased. The AC corrosion rate in the simulated acidic soil solution was higher than that in the simulated alkaline soil solution under the same AC current density. The direct current (DC) potential of X100 pipeline steel in the presence of AC current had a negative shift with respect to the natural potential. The real-time potential oscillated sinusoidally at the same frequency as the applied AC current, and the oscillation amplitude increased with an increase in AC current density. The AC corrosion products of X100 pipeline steel in the simulated acidic soil solution were less protective to the metal matrix than those in the simulated alkaline soil solution. For AC current densities greater than 100 A/m² in simulated alkaline soil solution and 200 A/m² in simulated acidic soil solutions, localized corrosion occurred, whereas general corrosion occurred under lower AC current densities.

Keywords: X100 pipeline steel, stray AC interference, AC corrosion, corrosion behavior, simulated alkaline soil solution, simulated acidic soil solution

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