The Dependence of Electrochemical Behaviors on the Corrosion Products of L360NCS Steel Exposed to Wet H2S Environments

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The corrosion behavior and electrochemical characteristics of carbon steel in H2S environment were investigated in this paper under different temperatures. Results showed that the corrosion rate of steel increased first from 0.413 mm/a to 0.889 mm/a with the temperature changed from 25 to 75 °C, and then decreased to 0.298 mm/a with the temperature increased to 90 °C. Electrochemical impedance spectroscopy (EIS) showed that the reaction presented charge-transfer and diffusion-controlled mechanism when temperature ranged from 25 to 75 °C; while at 90 °C, the result showed a charge-transfer reaction. The polarization curve revealed the linear polarization resistance (LPR) decreased first and then increased as temperature rose. The results related to the reduced solubility of H2S in water and enhanced reaction rate with increased temperature. Mackinawite was the main corrosion product, and the ratio of mackinawite increased while the grain size of corrosion products decreased with the increase of temperature.

Keywords: Carbon steel; Electrochemical impedance spectroscopy (EIS); Oil and gas; Sulfidation; Weight loss

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