Corrosion Behavior of Drill Pipe Steel in CO₂-H₂S Environment

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In this paper, scanning electron microscopy, potentiodynamic polarization tests and electrochemical impedance spectroscopy were used to examine the effect of H₂S concentration on H₂S/CO₂ corrosion of pipeline steel. The results showed that the corrosion process of the steel when H₂S coexists with CO₂ at different H₂S concentrations is related to the morphology and consistency of the corrosion product film. When a small quantity of H₂S was added, the surface area of the anode reaction zone decreased due to the continuous adsorption and separation of more substantial FeS deposits or a greater amount of FeHS⁺ ions on the steel surface. At the same time, the dual layer capacitance decreased, while the anion adsorption capacity improved. Consequently, the inhibition of the corrosion process was realized. After the addition of a small quantity of H₂S under the environment such that H₂S coexists with CO₂, the general corrosion rate of the steel declined quickly. Some elements of the corrosion product film became loose or even diminished when H₂S concentration became higher. As a result, the protective effect of the corrosion product film was reduced, and the rate of corrosion increased.

Keywords: H₂S; Corrosion; Electrochemical impedance spectroscopy; Carbon dioxide

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