Cathodic Reactions Involved in the Corrosion of X80 steel in Acidic Soil Simulated Solution

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Research on soil corrosion mainly focused on the impact of soil parameters on corrosion behavior, but the cathodic corrosion reaction of steel in acidic soil has not been studied systematically. In this work, the cathodic reaction involved in the corrosion of X80 steel in acidic soil simulated solution under various conditions were analyzed, along with data from hydrogen collection testing and the polarization curve. In the acidic soil simulated solution, the cathodic corrosion reaction of X80 steel depended on the combined effects of pH and dissolved oxygen (DO) concentration. For pH 5.0, oxygen-consuming corrosion occurred, and the corrosion rates in oxygen-adequate and anoxic system (0.90~0.25 ppm) depended on the oxygen ionization reaction and oxygen diffusion process, respectively. For pH 4.0 and DO >1.90 ppm, the depolarization of oxygen was still the main cathodic reaction, but hydrogen evolution dominated the cathodic process when DO was 0.25 ppm. In addition, both the reduction reactions of O₂ and H⁺ were present in the solution of pH 3.0, but the hydrogen reduction contribution was the key factor.

Keywords: X80 pipeline steel; Acidic soil; Corrosion; Cathodic reaction; Hydrogen evolution (HE)

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