Simulation and Experimental Verification of Buried Pipeline Corrosion under the High-Voltage Direct Current Interference

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Aimed at the corrosion caused by the ground current of the high-voltage direct current (HVDC) transmission system to adjacent buried pipelines, horizontal delamination is carried out according to different soil conductivities, and a field-circuit coupling model combining a resistor network model with an electric field model is established for the first time. The FEM model analyzed the distribution law of the grounding current in the soil, the change law of the ground and the pipeline potential, and the corrosion law of the buried pipeline caused by the ground current. Accurate judgment of the corrosion location of the buried pipeline and the quantitative calculation of the pipeline metal corrosion rate were all realized in the simulation. To verify the accuracy of the simulation, this paper develops an experimental platform on a small scale for the simulation model. The simulation and experimental results show results on the following fronts: a) under the influence of the HVDC grounding electrode ground current, the surface potential and pipeline potential cannot reflect the corrosion law of the buried pipeline; b) the corrosion location and corrosion degree of the buried pipeline mainly depends on the corrosion current density of the electrochemical reaction of the metal anode zone, and c) the different laying angles of the buried pipeline will change the corrosion location and trend of the pipeline metal.

Keywords: HVDC, finite element model, field-circuit coupling, corrosion experiment, buried pipeline

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