Cathodic Protection of X100 Pipeline Steel in Simulated Soil Solution

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Generally, the basic parameters of conventional cathodic protection design mostly rely on theoretical or empirical approximate formulas. An over protection phenomenon has emerged for pipeline systems with large scale differences in soil environment. This paper investigated the basic parameters of the electric cathodic protection under three types of simulated soil solution environments (Korla station, Lhasa station and Yingtan station) for X100 high strength pipeline steel by using the technology of electrochemical impedance spectroscopy (EIS) combined with polarization curves. The results showed that the EIS and polarization curves can help determine the basic parameters for X100 high strength pipeline steel cathodic protection under the above three simulated soil solution environments. Also, the changing characteristics of charge transfer resistance (R_t) and cathode potential change (E) changes, can be achieved by fitting EIS results: with negative potential shifting, R_t appeared a maxima value; Hydrogen evolution reaction started at the stage when $R_t < 1000 \Omega \cdot \text{cm}^2$; For X100 high strength pipeline steel under different simulated soil solution environments at Korla station, Lhasa station and Yingtan station, the size of hydrogen evolution potential was successively reduced.

Keywords: X100 pipeline steel; cathodic protection; polarization curves; EIS

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