(Topics)

Electrochemical corrosion mechanism of Q235A steel in the treated water containing halide (F-, Cl-) ions from nonferrous industry

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**Abstract:** Contemporarily, the only way to solve the discharge of heavy metal-containing wastewater from the nonferrous metallurgical industry is to improve the recycling ratio of the treated water and achieve the objective of zero discharge. Whereas, another question is if the Q235A steel pipeline will corrode as a result of the water impurities that contain fluoride and/or chloride ions during the entire recycling process. Accordingly, it is significative to investigate the corrosion mechanism of the pipeline induced by chloride ion and/or fluoride ion in the treated water. In this research, the electrochemical property and corrosion mechanism of the Q235A steel in the treated water containing Cl-, F- have been deduced theoretically, and investigated by electrochemical impedance spectroscopy (EIS). An equivalent circuit model for the electrode/electrolyte interface was proposed. A comparison was made in different treated waters containing Cl-, F- ions. According to the proposed model, we fitted the experimental impedance data to the theoretical data. It is shown that when the Q235A steel corrodes in the treated water with halide ions, its Nyquist plots consists of two capacitive loops in the first phase. Besides temperature and the concentrations of reactants, there are another two factors which determined the electrochemical corrosive rate: the electrode potential and the coverage ratio of halide ions on the surface of the Q235A steel. Therefore, the corrosion mechanism has been ascertained, and the second step is the rate-determining procedure of the electrode processes.

**Keywords:** Q235A steel; chloride; fluoride; electrochemical corrosion mechanism; electrochemical impedance spectroscopy (EIS)