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# Development of Prediction Techniques for Localized Corrosion Initiation in Concentrated Chloride Solutions Using Potential Noise Method

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Summary

(1) Development of a prediction technique for the initiation of stress corrosion cracking by potential noise method

The electrochemical noise analysis has been gained attention as a promising method for monitoring the severity of stress corrosion cracking (SCC) to the materials in chemical apparatus. In this study, we have developed the specimen for monitoring SCC, which could be safely and readily installed in actual salt manufacturing plants.

A short pipe with a pair of flanges that was fabricated from a SUS304 stainless-steel was used for the specimen. A residual stress as high as 200 MPa was casted on the inside of the short pipe by a high-frequency heating treatment. A potential difference between the short-pipe specimen and a short-pipe of pure-titanium (reference electrode) was continuously measured every 0.5 s. An aerated NaCl solution of 10 mass% was used for the test solution. The flow velocity of the test solution was controlled at 2 m/s. The test results showed some corrosion-potential noises that would be associated with the initiation of SCC generated at a solution-temperature of 60℃. The traces of initial stress-corrosion cracks were confirmed on the inner-surface of the short-pipe specimen that had been used the test.

(2) Effects of the trace amount of metal ions on the stress corrosion cracking susceptibility of type 304 stainless steel

The copper alloys such as Monel Metal, cupronickel and brass are frequently used to the material of heating tubes and evaporator of a salt production plant. In the salt production environment, these copper alloys are gradually corroded while stainless steels and nickel-base alloys are passivated. In this study, it was investigated that the effect of the small amount of $Cu^{2+}$ and $Cu^{+}$ as well as $Ni^{2+}$ and $Zn^{2+}$ to the susceptibility of stainless steel to SCC in a concentrated chloride solution by using the slow strain rate technique. The obtained result showed that the existence of $Cu^{2+}$ greatly accelerated the susceptibility, even in whose amount was as small as 10 mg/L. When the $Ni^{2+}$ was coexistence with the $Cu^{2+}$, the susceptibility was promoted further.