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Demonstration Tests of the Potential Noise Sensor for Field Use for Monitoring Stress Corrosion Cracking in Simulated Salt-Manufacturing Environments

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Summary

The objective of this study is to demonstrate the applicability of the potential noise technique to the corrosion monitoring for salt production equipments in actual use.

An electrochemical sensor for the potential noise measurement was made up of a pair of double flanged short-pipes; one flanged pipe made of type-316L stainless was a working electrode and the other one made of pure-titanium acted as a reference electrode. They are coupled each other through an insulating gasket. The working electrode was machined by turning and drilling from a type-316L bar with 140 mm in diameter, and a tensile residual stress was applied around the center of its inner surface with an induction heating technique.

The measurement was carried out by using a flow-test equipment, at the research institute of salt and sea water science, the salt industry center of Japan. A 27 mass% $MgCl_2$ solution at 50 to 70°C was used for the test solution, which was opened to air and flowed at 2 m/s. The potential noises were obtained from the potential differences between the working and the reference electrode. The potential differences were sampled every 0.5 s continuously, through a voltmeter with high input-impedance.

Fig. 1 shows the typical example of the potential noise measured at 60ºC. As shown in the figure, the RD-type potential noises, which corresponds to the initiation and the repassivation of metastable localized corrosion, were obtained. Since the small pits were confirmed at the some parts of inner surface of the working electrode that was used for the measurement shown in Fig. 1, the measured RD-type potential noises were estimated to have been generated by the initiation and the repassivation of metastable pits, which are widely recognized as precursory phenomena of SCC.

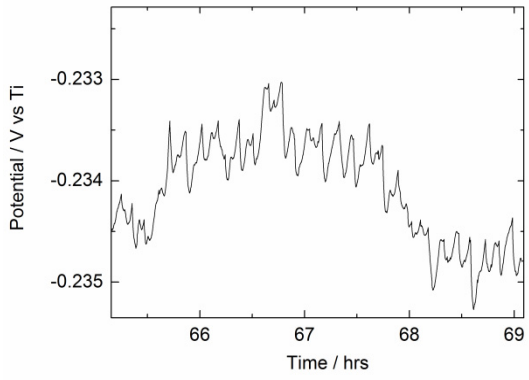

Fig. 1. Typical example of the potential noise measured at 60ºC