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Monitoring and Diagnosis of Local Corrosion at Salt Product Plants by an Optical Fiber AE System

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Summary

In plants for salt production, crevice corrosion frequently occurred at flange connection even where high Ni-contained stainless steel is used due to use of high concentrated sea water in the plants. Crevice corrosion in the plants leads to not only leakage of process liquid but also generation of corrosion product or rust as contamination for products. However, crevice corrosion cannot be directly observed by a visual inspection without dissembling a pipe work. Therefore, this study aims to detect and monitor the initiation and progression of crevice corrosion occurred at an flange connection with an acoustic emission technique under continuous flowing condition and study correlation between acoustic emission parameter such as hit rate and frequency component of AE and corrosion progression. This study is composed of four sections. At first section, crevice corrosion under corrosion potential control was monitored by PZT type AE sensor to investigate possibility of AE monitoring for crevice corrosion. Many burst type AE waves were detected during testing. Most of AE source location agreed fairly with corrosion area. AE generation rate increased with increase of anode current. At second section, AE monitoring for crevice corrosion at a flange connection under continuous flowing condition was performed with artificial concentrated sea water which consist of 20 wt% of NaCl, 0.62 wt% of KCl, 2.5% $MgCl_2$ and 0.57% $CaCl_2$. AE was monitored with four PZT type AE sensors on distal surface of a flange. AE generation and turning artificial sea water red due to generation of rust were observed close to the same time. AE generation rate during testing equaled to 10 to 30 events / hour. Peak frequency of detected AE was shifted to higher up to 300 kHz with progression of corrosion. At third section, AE from crevice corrosion was monitored with a developed optical fiber AE monitoring system. This developed system can monitor AE for three flanges using by one optical fiber individually in which sensors with difference frequency responses was fabricated by winding an optical fiber on cylinders with different diameter. These sensors can detect AE from crevice corrosion at individual flange under continuous flowing test. AE generation rate correlated with degree of corrosion progression. As a result, it is found that AE method is a potential tool for monitoring crevice corrosion at a flange connection in salt product plant.