Basic approach to the application of extreme value statistics analysis to localized-corrosion monitoring technique using potential noise method for salt manufacturing plants

Hiroyuki Inoue
College of Engineering, Osaka Prefecture University

Recently, many attempts have been made to monitoring the initiation of pitting and stress corrosion cracking by analyzing potential noise. The potential noise is generated from the initiation and the repassivation process of non-propagating localized corrosions.

The potential noise measurement uses probe electrodes with small area, whose material are equivalent to the monitoring objective with large area, such as an equipment for salt manufacturing plants. Because the pit initiation is a phenomenon that includes stochastic process, the maximum pit depth on the probe electrode is always smaller than that over the monitoring objective. This means that a propagating pit might be initiated at a location on the monitoring objective, even under the conditions that only non-propagating pits are existing on the probe electrodes. In order to overcome this problem, the author came up with the idea of using extreme value statistics for the analysis of the potential noise. In this study, it was examined that whether the maximum pit depths on the electrodes follows Gumbel distribution, and it was investigated the possibility for the application of the extreme value statistics to the pitting monitoring using the potential noise method.

The potential noise of SUS304 stainless steel specimens with 10mm^2 exposed area was measured in 10mass% NaCl solutions at 60, 70 or 80°C. The measurements were carried out several times under each conditions for 48 hours. The corrosion potential of the specimens were measured continuously every 0.5s with a precise digital voltmeter and a silver/silver chloride electrode. The maximum pit depths in each measurement were estimated from the analysis of measured potential noises by using the RPS method. The estimated depths were plotted on a Gumbel probability plotting paper. The results in GEV analysis showed that the maximum pit depths (radiuses) at 80 and 70°C would follow the Gumbel distribution. The obtained results might suggest the possibility of the application of extreme value statistics to a pitting-corrosion monitoring using the potential noise measurement.