The 10th TSME International Conference on Mechanical Engineering
10th – 13rd December 2019
Pattaya, Thailand

Generation Mechanism of Acoustic Emission signals from Corrosion under Coating Film by AE source wave analysis

Atsuya SUGIMOTO[1], and Takuma MATSUO[2]

[1] Department of Mechanical Engineering, Graduate School of Science and Technology, Meiji University
[*] 1-1-1 Higashi-Mita, Tama-ku, Kawasaki-shi, Kanagawa, 214-8571, Japan
ce192047@meiji.ac.jp, +81-44-934-7737

[2] Department of Mechanical Engineering, School of Science and Technology, Meiji University
[*] 1-1-1 Higashi-Mita, Tama-ku, Kawasaki-shi, Kanagawa, 214-8571, Japan
matsuo@meiji.ac.jp, +81-44-934-7737

Abstract

The occurrence of corrosion under coating film of steel structures poses a problem to condition monitoring, because it is difficult to detect damages by visual inspection in these cases. Thus, identifying the mechanism of corrosion is important in order to monitor the health of structures possessing coating film. Acoustic Emission (AE) is a method that can be used to estimate the mechanism of damage formation. Our previous studies have shown that the AE detected during tensile tests conducted on steel plates with zinc-rich paint film contains a large number of low-frequency components. The AE signals obtained from steel—subjected separately to atmospheric corrosion and corrosion under coating film—could be classified by focusing on the maximum peak frequency upon consideration of the material characteristics of the AE source. In this study, AE source wave analysis was conducted on AE signals obtained from corroded steel (under two cases) in order to understand the progression of the corrosion process in detail. This analysis estimated the speed and volume of crack formation by inverse analysis of the detected elastic waves. Initially, the corrosion of the steel was promoted by spraying NaCl solution on two specimens: a bare steel plate (subjected to atmospheric corrosion) and a painted steel plate (subjected to corrosion underneath coating film). Next, we calculated the crack parameters from the aforementioned obtained AE signals using the overall transfer function, which was determined using laser ablation as a pseudo sound source. Further, we established the possibility that the mechanism of corrosion under coating film can be estimated from the calculated crack parameters.

Keywords*:* Acoustic Emission, Source Wave Analysis, Corrosion, Coating film