World Academy of Science, Engineering and Technology
International Journal of Electrical and Information Engineering
Vol:16, No:06, 2022

Monitoring Saltwater Corrosion on Steel Samples Using Coda Wave Interferometry in MHZ Frequencies

Authors : Maxime Farin, Emmanuel Moulin, Lynda Chehami, Farouk Benmeddour, Pierre Campistron

Abstract : Assessing corrosion is crucial in the petrochemical and marine industry. Usual ultrasonic methods based on guided waves to detect corrosion can inspect large areas but lack precision. We propose a complementary and sensitive ultrasonic method (~ 10 MHz) based on coda wave interferometry to detect and quantify corrosion at the surface of a steel sample. The method relies on a single piezoelectric transducer, exciting the sample and measuring the scattered coda signals at different instants in time. A laboratory experiment is conducted with a steel sample immersed in salted water for 60~h with parallel coda and temperature measurements to correct coda dependence to temperature variations. Micrometric changes to the sample surface caused by corrosion are detected in the late coda signals, allowing precise corrosion detection. Moreover, a good correlation is found between a parameter quantifying the temperature-corrected stretching of the coda over time with respect to a reference without corrosion and the corrosion surface over the sample recorded with a camera.

Keywords : coda wave interferometry, nondestructive evaluation, corrosion, ultrasonics
Conference Title : ICU 2022 : International Conference on Ultrasonics
Conference Location : Paris, France
Conference Dates : June 23-24, 2022