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CHARACTERIZING CORROSION IN CARBON STEEL PIPES USING ACOUSTIC EMISSION TECHNIQUES: THE IMPACT OF TEMPERATURE AND CURRENT DENSITY

Mohd Fairuz Shamsudin
Faculty of Mechanical Engineering, University of Technology, Malaysia
mohdfairuz@utm.my

Abstract

Acoustic Emission (AE) testing is a non-destructive method widely used for structural damage identification. This study explores AE's application in monitoring corrosion activity in carbon steel material commonly used in pipelines. This research initially focused on examining the correlation between current density and the corrosion rate of carbon steel. ASTM A106 Gr B pipe specimens were submerged in 3.5 wt% sodium chloride solution supplied with varying current density between 0.0125A and 0.25A. Weight loss measurements were conducted for each test, revealing a direct correlation between current density and the corrosion rate. Subsequently, an experiment using AE monitoring device was conducted under identical conditions to establish a relationship between current density and AE count rate, which represents acoustic activity during the corrosion process. Conversely, the results indicated that as the current density increased, the AE count rate decreased. To validate these findings, a potentiodynamic polarization test was conducted, substituting current density variation with temperature as the main variable while maintaining the same concentration of sodium

chloride. This test suggests that acoustic emissions are affected by factors beyond corrosion progression, including current densities and temperatures. The study concluded that the AE count rate is inversely proportional to the corrosion rate. This discrepancy is attributed to the formation of a passivation layer on the surface during corrosion, which reduced corrosion activity hence acoustic emission.