Detecting corrosion of oil tank bottom based on acoustic emission (AE) technology

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Abstract Corrosion of oil tank bottom dramatically threatens safety production of petrochemical industry. Conventional ultrasonic inspection, magnetic flux leakage and other nondestructive testing (NDT) technologies involve time-consuming and labor-intensive production suspension and tank cleaning. Acoustic emission (AE) is an emerging passive NDT approach without interrupting normal operation. But the AE signals are easily interfered by ambient noise. In response, this work aims to improve noise processing and severity determination performance of AE technology in detecting oil tank bottom corrosion. An AE inspection platform that consists of vertical oil tank, AE monitoring system and AE analysis software was designed and constructed. To identify the AE sources of ambient noises, time-frequency domain features of AE signals are extracted and a BES-SVM algorithm was proposed. It achieves 95% of accuracy in recognition of seven artificial AE signals in experiments. Moreover, to evaluate the severity of oil tank bottom corrosion, one-dimensional AE signals are converted into two-dimensional mel-spectrum and convolutional neural network (CNN) is employed to handle the mel-spectrum to determine corrosion severity. Experiments shows that over 95% of corrosion in different degrees are successfully identified by the mel spectrum-based CNN model.

Keywords Corrosion inspection; Oil tank bottom; Acoustic emission (AE); BES-SVM algorithm; Mel-spectrum; Convolutional neural network (CNN)