Corrosion Under Insulation Monitoring and Risk Assessment System by Galvanic Corrosion Sensor

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Corrosion under insulation (CUI) is a serious issue for pipes or equipment that are insulated to protect the temperature fluctuations of the flowing medium within the pipe or equipment. This type of damage can have catastrophic effects on asset integrity, production losses, health and safety, and the environment in the chemical and petroleum industries. CUI is a form of external corrosion that occurs on the underlying metal beneath insulated equipment due to water ingress through the insulation layer. Moisture that causes corrosion under insulation can be caused by external factors, such as damage to the insulation that allows water from outside to ingress into the system, or it can be caused by water condensation due to temperature differences in the equipment. CUI is difficult to predict and detect. Usually, CUI is detected when the medium inside has leaked into the environment. In addition, inspecting the CUI is difficult, costly, and time intensive. Nowadays, the primary approach for locating CUI in the chemical and petroleum industries is visual inspection, which necessitates removing some or all of the insulation. Inspectors must physically remove the insulation and external jacketing/cladding before doing a visual inspection in order to analyze and assess the equipment's surface condition. However, a lack of or insufficient inspection schemes can result in medium leaks and the loss of production. In addition, collateral costs associated with scaffold building, insulation removal, and reinstallation can be enormous. Through the use of non-destructive testing (NDT), end users can conduct corrosion detection without suffering significant operational disruptions. Some NDT techniques allow CUI detection without removing insulation and exterior jacketing. Infrared thermography, radiography examination, ultrasonic inspection, and eddy current are examples of NDTs that are frequently used.

In this research, a new NDT technique for insulation corrosion monitoring systems was developed. A small galvanic corrosion sensor was installed between the device insulations to detect corrosion. When the device is under corrosion conditions, the sensor generates a galvanic current. The galvanic current from the sensor is used to indicate the severity of corrosion under the insulation, predict corrosion rates for carbon steel devices, and determine the average maximum pinhole depth in stainless steel devices. In addition, the sensor can also work with a humidity sensor and a temperature sensor to monitor corrosion under insulation in the system. Furthermore, on corrosion monitoring during field exposure tests for a year, it was found that the CUI sensor still responds well to corrosive conditions.