RFID Corrosion Sensors

W. H. Smyrl

Commercial RFID tags, suitably altered to enable direct chemical sensing, offer a novel way to monitor the health of engineering structures. Passive tags are inexpensive and small, and form a basis for "active" devices for later stages of research and development. In published work, commercial passive RFID tags, have been altered with film coatings to detect chemical species. The RFID response signal was analyzed to determine the "chemical shift" of the impedance as a signature of individual species. The technique is direct and utilizes inexpensive RFID components that may be a few cents each.

The research discussed here intends to overcome the problems of the traditional approaches to characterize the corrosion of metals with new wireless sensors. These will be: (1) small with no connecting wires so that they are not intrusive; (2) inexpensive so that multiple units could be embedded at distributed locations, and; (3) tailored to enable unequivocal predictions of the metal corrosion process in technological conditions.

Metals used for engineering structures in modern societies are thermodynamically unstable in their service environments. Characterizing degradation reactions is difficult for nonuniform attack, because they change with time, especially for buried metals under an aggressive environment that mediates their rates. Buried dynamic interfaces are the most difficult systems to characterize and to protect.

Corrosion under insulation (CUI) is initiated when water, for example, intrudes through insulation used to cover metal pipelines and other structures. The need is to sense the presence of condensed moisture at local regions of the underlying metal surface to enable remedial action before substantial degradation has occurred. This will prevent eventual failure of the structure and costly downtime for replacement. The sensing of condensed moisture will be the objective of the present research. Successful development will be a template for sensing corrosion of metals embedded in aggressive environments, such as metal reinforcement under cast concrete in bridges, roadways, and other structures.

The discussion here will review previous studies that begin to address the objectives described above and ongoing work in our laboratory to provide Corrosion Alarm warnings.