

## **Corrosion Sensing Beyond Electrochemistry**

Andraž Legat, Bojan Zajec, Miha Hren, Simon Pavlič, Tadeja Kosec

*Slovenian National Building and Civil Engineering Institute (ZAG)  
Dimičeva 12, SI-1000 Ljubljana, Slovenia  
E-mail: andraz.legat@zag.si*

Classical electrochemistry postulated by Wagner and Traud is the basis for the evaluation of general corrosion properties of metals and alloys in various environments. Different electrochemical techniques like linear polarization, potentiodynamic tests, electrochemical impedance spectroscopy, etc. based on this theory can provide main electrochemical parameters, including depassivation potential and general corrosion rate. It should be noted, however, that three basic conditions for the reliable determination of these parameters are required: the existence of the mixed potential, stationarity of a process, and uniformity of a process. Actually, in a large part of corrosion processes one or more of these conditions are not fulfilled. A few typical cases including pitting corrosion, atmospheric corrosion, corrosion in concrete and stress-corrosion cracking will be presented and discussed. In this sense, specific results of various measuring techniques and their combinations, as electrochemical noise, coupling multi-electrode array (CMEA), acoustic emission (AE), and electrical resistance sensors (ER), will be presented and interpreted. An attempt to evaluate benefits and limitations of these techniques in comparison to the conventional ones will be made. In this sense also the critical parameters of highly non-stationary and non-uniform corrosion processes will be highlighted.