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Model Modules to Assist Assessing and Controlling Stress Corrosion Cracking #126
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We introduced EIS (Electrochemical Impedance Spectroscopy) as an electrochemical tool to characterize the interface metal-electrolyte at different conditions during hydrogen permeation tests, and for mechanistic analysis under unload conditions for different NN (Near neutral) solutions. The kinetic model developed and programmed considers corrosion products rate and the hydrogen diffusion throughout the bulk and formation at the interface, by using EIS we incorporate quantitative information to validate and explain the kinetic model, and the mechanism that is proposed for hydrogen formation at the interface and in the bulk for unload conditions.

From experimental measurements for unload conditions, there are critical ionic species for NN solutions that were characterized from the electrochemical point of view, and used to design experimental procedures for load conditions. SCC cell was designed to follow critical parameters for cyclic softening (microplasticity) while hydrogen evolution is detected from homogeneous and heterogeneous reactions. Chloride and bicarbonate ionic species in combination with different temperatures are reactants for anodic dissolution and hydrogen reactions respectively, where locally changes at the electrolyte might occur once the critical concentration of both reaches the interface of the metal-electrolyte. Hydrogen transport is considered in the theoretical model, from the hydrogen ions that are within the bulk solution to the diffusion of atomic hydrogen within the metallic structure.

Work thus far has focused on improving the characterization for near-neutral SCC (NNSCC), from the mechanistic analysis and under unload and load conditions, electrochemical techniques such as EIS and standard time domain techniques (Potentiodynamic and potentiostatic techniques) are going to be used for characterization and parametric results for load conditions.

Furthermore, laboratory experiments that are underway will result in data for further validation of the theoretical approach and will improve the kinetic model and start new relations for the life prediction model.