Mechanistic Evaluation of SCC in Sensitized and Unsensitized Specimens of AA5083 Using Localized Probing Techniques

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There is a continuing effort to ascertain the mechanism of and to prevent stress corrosion cracking (SCC) and hydrogen induced cracking (HIC) in aluminum alloys. However, questions still remain about the detailed mechanisms of cracking due to the possible involvement of hydrogen. When as-received or sensitized AA5083 are immersed in an electrolyte, a growing crack creates a galvanic couple with the external surfaces according to the differential aeration hypothesis. Monitoring the resulting “coupling current” yields information about the mechanisms of crack advance. The purpose of this study is to determine if the scanning vibrating/reference electrode technique (SVET/SRET/SVP) can be used to monitor the coupling current flowing through the solution. If successful, this method, which maps potential as a function of probe position, might be used to visualize and quantify the coupling current emanating from a growing stress corrosion crack in sensitized and un-sensitized aluminum alloy samples to yield more localized information about the crack growth process. Preliminary feasibility studies were performed to map the current/potential in a larger galvanic couples designed to simulate Cu-rich intermetallics dispersed in an aluminum matrix as in AA2024 and Mg-rich intermetallics in AA5083.