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ABSTRACTS

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Accelerated Testing of MIC Resistance of Materials and Weldments using Flow-through Testing with Indigenous Microbiota

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Microbes recovered from sediments, slimes, or tubercles are characterized into functional groups, identified by fatty acid patterns and utilized in a flow-through test system in which the bulk phase mimics the composition of the system to be examined. The bulk phase is supplemented with nutrient for the microbes which allow less than 10% of the growth achieved in enriched medium in a batch culture. The bulk phase is sterilized and moved through a test system consisting of a glass kettle with a polypropylene top at a rate sufficient to replace at least 10% of the volume per hour in a once-through flow system. Four-sided electrodes of the substratum (alloy or weldment) serve as independent working electrodes. These can be twisted to provide correct geometry relative to the calomel reference electrode Lugin probe. The whole bundle is surrounded by a platinum screen circular electrode to for a three electrode test system. The system is monitored continuously for open circuit potential (OCP) and electrochemical noise. At periodic intervals the corrosion is monitored by electrochemical impedance spectroscopy (EIS) in which a $\pm$ 5mV potential is impressed with sinusoidal wave form over a frequency range of 5mHz to 1OHz. Once the biofilm is established on the electrodes (OCP), the average corrosion rate is determined from the charge transfer resistance (EIS), and evidence for localization from the phase angle shifts (EIS) is recorded. Multiple kettles provide replications and they are maintained at the temperature and pressure of the system on which the accelerated test is modeled. When the responses are tabulated the actual microbial community on the electrodes is recovered for viable counts and for community structure analysis with signature lipid biomarkers or nucleic acid probes. Preliminary experience indicates these accelerated tests provide sufficiently good models of field exposures for materials decisions.