High Throughput Electrochemical Tests for General and Localized Corrosion

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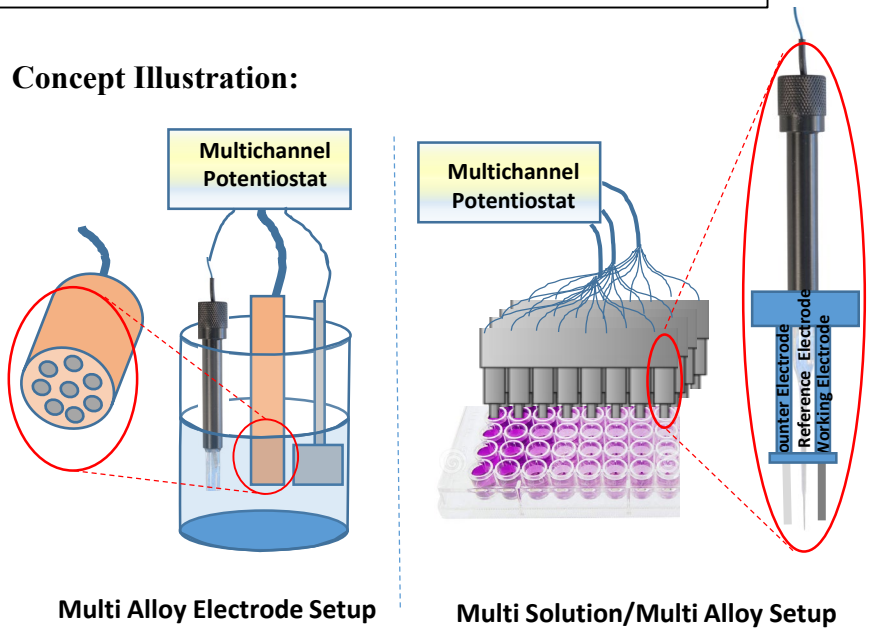
Objectives: Develop high throughput electrochemical test methods to evaluate general and localized corrosion behavior to screen large number of alloys in an environment or an alloy in multiple corrosive environments.

Technical Approach: Alloy selection for corrosion resistant materials for a chemical environment takes a long time. Electrochemical methods are typically used to determine the corrosion rate and localized corrosion behavior of alloys in each corrosive environment. Corrosion rates can be determined over time by using linear polarization resistance (LPR) method or electrochemical impedance methods (EIS). Similarly, cyclic polarization methods are used for determining the localized corrosion susceptibility of alloys. However, it can take a long time to screen a large number of alloys in one environment or will require a lot of equipment. Similarly, to generate data on the effect of different environmental parameters on corrosion behavior of a newly developed or alloys, corrosion tests need to be carried out in each simulated environment of interest. High throughput electrochemical test setups will allow multiple corrosion tests done simultaneously for multiple alloys in multiple corrosive environments. Number of tests that can be done in parallel will depend on the availability multichannel potentiostats or multiplexers available. This screening approach is similar to the one used for drug development where initial screening of large number of chemicals/variables can be done in parallel to save time. Selected criteria for selection can identify alloys or environments for more detailed experimentation.

Concept Illustration:



Impact: Generation of corrosion performance data for an alloy in simulated environments can take a long time. Screening of a large number of alloys for a given environment or testing of an alloy in a variety of corrosive environments can be done by more efficiently by using high throughput testing approach. This will help with development or selection of appropriate alloys for a given environment. Development of high throughput testing approach to corrosion testing can also help with selection of additive manufacturing process parameters for optimum corrosion resistance in a given environment.