Corrosion Technology

Creating Data You Can Actually Use to Make Decisions

Stress Engineering Services specializes in customized corrosion testing in our state of the art corrosion laboratories. We are able to conduct standardized corrosion tests such as ASTM G36 and NACE TM0177, but our main focus has always been in duplicating as closely as possible the situations that our customers face in real life. We want to provide you the results you need, in the way you need them. All our reports are custom written to your specifications.

Flow Regime Simulation

Flow regime simulation is one of our most frequently requested test protocols, often requiring test protocols that cover the full range of potential flow regimes from slug flow to stratified flow and under deposit corrosion. Jet Impingement testing is one of our most important tests. This test is useful in understanding the corrosion process in situations where you have turbulent flow. In our corrosion lab we can change the amount of turbulence to see how quickly corrosion will occur (the corrosion rate), of great importance, to measure the effects of a range of flow regimes on the efficiency of various corrosion inhibitors.

Under-Deposit Tests

Under-deposit tests can be used to determine how corrosion looks under a sand or corrosion product layer, for example iron sulfide. These tests are conducted in autoclaves for high pressures and temperatures or glassware and generally last 30 days. This is helpful when you have low flow conditions where sand or corrosion product can settle on the bottom, for example, low flow pipelines, vessels and tanks.

Weight Loss Tests

If you are concerned about the overall corrosion rate (the speed at which the corrosion will occur) and/or the corrosion morphology, a weight loss test is recommended. This test can be used to determine how an inhibitor minimizes the corrosion and affects pitting and crevice corrosion. If you are only interested in the corrosion rate and not morphology, an electrochemical test may

be a better method. This test can show the effects of inhibitors at various dosages and changes over time.

Cracking

If cracking is your primary concern, we can test using 4-point bent beam, c-ring or double cantilever beam tests to determine cracking susceptibility. These tests are usually done in triplicate, as cracking is not always reproducible, and the tests up to 30 days to complete. We can accommodate c-rings up to 3" in size (outer diameter). Otherwise, the tests are done with 4-point bent beam or double cantilever beam specimens. If you are interested in the temperature at which cracking occurs, we can use an acoustic emission system to "listen" for the crack initiation at increasing temperatures.

Sweet or Sour Environments

Most of our tests can be performed in both sweet (CO_2) and sour (H_2S) environments at temperatures up to about 450°F and pressures up to about 1800 psig. Even the electrochemical tests can be performed at temperatures up to about 250°F and pressures up to 800 psig (though the presence of H_2S may affect the types of electrochemical tests that may be performed).

Electrochemical Tests

We have a full suite of electrochemical corrosion test methods that can be used as needed. We can perform potentiostatic, potentiodynamic, linear polarization resistance (LPR), galvanic corrosion, galvanostatic, electrochemical noise (EN) or electrochemical impedance spectroscopy (EIS) using Gamry technology. Depending on the information you hope to gain from your test matrix, any of these techniques may be used. The effect of heat transfer can also be incorporated into these electrochemical parameters.

Coatings

If you are interested in coating performance, we can design a variety of setups to determine fluid absorption, blistering or coating disbonding. We can test the effect of heat transfer on internal coating performance, and can test coatings in turbulent systems using our jet impingement apparatus.

- Full immersion coatings evaluation
- Cathodic disbonding
- Cold wall effect evaluation
- Electrochemical and acoustic emission (AE) monitoring and evaluation

Cathodic Protection

For cathodic protection systems we can determine the CP requirements to protect a material. We can also determine sacrificial anode efficiency. Another option is heat transfer testing which can be used to determine what kind and amount of cathodic protection is needed when the temperature of the product inside a pipe or tubing is different from the outside temperature , which may be very different than when the temperature is the same on both sides.

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Corrosion Testing In Sweet (CO_2) or Sour (H_2S) Conditions

- Stirred autoclave (to 1700 psi at 450°F)
- Flow accelerated corrosion using jet impingement techniques
- Electrochemical testing in glassware and autoclaves at high temperature and pressure
  - Linear Polarization Resistance (LPR), Electrochemical Impedance Spectroscopy (EIS), Electrochemical Noise (ECN, EN)
  - Potentiodynamic, Potentiostatic and Galvanostatic Polarization
- Corrosion inhibitor evaluation, including critical concentrations and inhibitor persistency
- Corrosion under heat transfer conditions, including electrochemical capability
- Corrosion in controlled low oxygen environments (ppb level)
- Under deposit corrosion evaluation, including electrochemical capability
- Corrosion Under Insulation (CUI)
- Crevice corrosion and pitting
- Cathodic protection requirements; galvanic anode performance and qualification
- Stress corrosion cracking (SCC); sulfide stress cracking (SSC)
- Acoustic Emission (AE) capability
- C-ring, 4-point bent beam, double cantilever beam (DCB)
- Galvanic corrosion evaluation
- NACE standard tests, including:
  - NACE TM0177 – Sulfide Stress Cracking (SSC); Method B, C and D
  - NACE TM0284 – Hydrogen Induced Cracking (HIC)
- ASTM standard tests, including:
  - ASTM G 48 – Stainless steel pitting and crevice corrosion in ferric chloride solution
  - ASTM G 150 – Critical pitting temperature (CPT) of stainless steels