Private Company

Predicting microbially induced corrosion in coated materials

MATERIALS

Background
We are a US-based, global player and market leader in the paints and coatings industry, offering a wide range of solutions, including coatings designed to protect infrastructure. Corrosion, particularly microbially induced corrosion or microbiologically influenced corrosion (MIC), also known as biocorrosion, poses significant risks to long-term infrastructure integrity. MIC occurs when microbial colonies, such as sulfate-reducing bacteria, iron-oxidizing bacteria, or other microbial species, form biofilms on metal or coated surfaces, accelerating corrosion through byproducts like acids or sulfides. Microbial growth can also occur on non-metallic materials, such as concrete, leading to biodeterioration, as some microbes can break down calcium carbonate and/or cause microbial-induced cracking. Although biodeterioration is not considered true corrosion, it similarly compromises structural integrity.

A major challenge for industries, ranging from infrastructure to protective coatings, is the lack of reliable lab methods to predict how substrates, especially coated ones, will perform when exposed to microbial attack in real-world conditions. This challenge spans various materials, including metals (e.g., steel, aluminum), pipelines, storage tanks and concrete, which experience degradation in diverse settings like ocean bridges, underground pipelines, and wastewater treatment plants. These environments often feature extreme or fluctuating conditions, including high temperature, salinity and moisture, varied pressure, and exposure to abrasive liquids and gases.

While multiple test methods, such as electrochemical tests, biofilm assays, coupon tests, weight loss tests, accelerated environmental chambers and microbiological molecular methods (MMM) are used to study MIC and biodeterioration, none are universally accepted as predictive for long-term field performance. This gap drives the need for new, more comprehensive testing methods that better simulate field conditions - capturing microbial diversity, biofilm dynamics, and environmental variability - while differentiating microbial corrosion and biodeterioration from other forms of corrosion or degradation caused by abiotic factors (e.g., saltwater or pollutants).

What we're looking for
We are looking for test methods that simulate long-term microbial exposure and its impact on both coatings and substrates, to better predict the performance of protective coatings and their ability to resist microbially induced corrosion and/or biodeterioration over extended periods.

We are interested in developing a standard method that goes beyond existing tests by addressing the full complexity of microbially induced corrosion (MIC), biodeterioration and environmental factors in a more integrated way. The goal is to use this test to drive continuous improvements in coating development as more performance data is gathered.

Solutions of interest include:

- Multi-parameter test chambers that simulate both microbial and environmental conditions, including temperature, pressure, moisture, and salinity, to predict long-term coating performance while distinguishing between microbial-induced and abiotic corrosion.
- Biofilm and material deterioration hybrid assays that measure not only biofilm growth but also its direct impact on material deterioration, linking microbial activity to corrosion under field-like conditions.
- Accelerated corrosion tests that adapt current state-of-the-art accelerated corrosion cabinet standards to include controlled microbial exposure, ensuring that both microbial activity and environmental stress factors are taken into account.
- A new standard testing method that simulates microbially induced corrosion and environmental degradation separately, allowing for isolated and combined analysis of microbial and abiotic factors influencing coating performance.
- Corrosion simulation models developed using historical corrosion data and comprehensive field monitoring from industries such as infrastructure and oil & gas, enabling accurate long-term performance prediction (if such data is available from external sources).

Our must-have requirements are:

- Replicate varied environmental conditions in a controlled lab setting.
- Simulate multi-species microbial exposure, accounting for microorganisms commonly found in target environments.
- Provide quantifiable data on both microbial activity and material deterioration, to assess corrosion rates and microbial resistance of coatings.

Our nice-to-have's are:

- Replicate long-term exposure in an accelerated time frame for faster results.
- Differentiate between MIC/biodeterioration and other forms of deterioration caused by abiotic factors (e.g. erosion, uniform corrosion, galvanic corrosion, etc.).
- Support post-failure analysis by providing insights into potential corrosion mechanisms based on simulated lab results.
- Integration with predictive modeling tools for future performance forecasting.
- Standard test organisms known to reliably provide MIC/biodeterioration of control materials and coatings.

What's out of scope:

- Technologies for corrosion detection and monitoring, such as probes, sensors, or gauges.

- Solutions focused on developing or improving protective coatings.
- Methods focused solely on detecting the presence or quantity of microbes in a sample.
- Approaches aimed at predicting microbial degradation in wood materials.

Acceptable technology readiness levels (TRL): Levels 2-5
1. Basic principles observed
2. Concept development
3. Experimental proof of concept
4. Validated in lab conditions
5. Validated in relevant environment
6. Demonstrated in relevant environment
7. Regulatory approval
8. Product in production
9. Product in market

What we can offer you
Eligible partnership models:
Sponsored research
Co-development

Benefits:
Sponsored Research
Up to $100,000 for a proof-of-concept, with additional potential funding for further development.

Expertise
Selected partners will be assigned a company partner to champion the project, identify gaps in expertise, and meet regularly to ensure project success and timely milestone targets. Partners will have access to our R&D scientists to provide feedback and guidance as needed.

Facilities and Services
We can offer complimentary testing and proof-of-concept validation at our facilities.

Please contact the University of South Florida Technology Transfer office representative for submission – Roisin McNally at rmcnally@usf.edu