CASE STUDY

think simulation | getting the chemistry right

Midstream Oil & Gas

Corrosion Analysis

Accelerating New Materials Innovation with Revolutionary Water Chemistry Insights

For decades, OLI Systems has worked with companies across the Oil & Gas (O&G) sector to improve safety, productivity, reliability, and performance at every stage of production. In this case study, OLI Systems collaborated with a customer looking to enhance materials selection for Midstream O&G operations. Researchers worked with OLI Systems to implement a powerful combination of state-of-the-art software and water chemistry analysis to rapidly design and run experiments in order to develop new corrosion-resistant alloys.

Industry Trends

Mitigating corrosion for optimal performance

The Midstream Oil and Gas (O&G) industry plays a major role in energy production. These operations are responsible for processing, storing, marketing, and transporting a variety of produced materials, making midstream companies a vital link between remote drill sites and refineries.

Midstream pipelines cover hundreds of thousands of miles, which make them highly efficient but also incredibly difficult to monitor and maintain. In fact, these materials are susceptible to extreme rates of corrosion as resources travel through pipelines—collecting water, salts, hydrocarbons, and other harmful contaminants. Corrosion poses major problems for midstream companies, from reduced efficiency and unplanned downtime to lost resources and catastrophic failure. As a result, today's companies are seeking a new breed of operating materials to treat and prevent corrosion.

Business Challenge

Developing a new class of operating materials

OLI Systems was contracted to help a customer resolve a research issue in the Midstream Natural Gas sector. The company houses a highly-equipped laboratory dedicated to the research and development (R&D) of coal, natural gas, and oil technologies, providing scientific and engineering expertise to create accessible solutions for rising energy demands and environmental problems. The company participates in strategic partnerships with industry leaders, technology developers, and academic institutions to further R&D efforts to drive energy independence for the future.

In this study, the laboratory was experiencing a problem conducting experiments on chloride solutions for a new class of alloys. The class was comprised of high-entropy alloys, an emergent cutting-edge technology with minimal literature for researchers to utilize. The laboratory needed to find the exact chemistry parameters and corrosion-causing variables to run in their experiments, which would allow them to assess the performance of each material and generate revolutionary insights to enhance materials selection. To accurately identify these components, the laboratory had to implement a new approach to water chemistry analysis.

Approach

Operationalizing water chemistry insights

The laboratory employed the extensive water chemistry expertise of OLI Systems to design and run their experiments. The objective of this project was to rigorously study the performance of high-entropy alloys in order to understand their corrosion behavior. They planned to operationalize these insights to enhance the design and manufacturing of new materials as well as deliver more effective, economic options.

With support from OLI Systems' experts, the laboratory utilized OLI Systems' industry-leading chemistry analysis software and comprehensive chemistry database to predict corrosion issues. Their mission was to mitigate and prevent corrosion in midstream operations and empower the R&D of future materials.

Solution

> "OLI Studio: Corrosion Analyzer was a game-changing tool that enabled our team to calculate the asset life of new alloys to determine the most viable materials for development."
>
> *– Midstream O&G Customer*

Harnessing experimental data for rigorous insight

The laboratory collaborated with OLI Systems at the beginning of the research phase to establish which known alloys, new alloys, and physical factors to study. Once the components were selected, researchers utilized OLI Systems' chemistry database to design a series of experiments to examine new alloys under varying environmental conditions.

Additionally, the laboratory adopted the OLI Studio: Corrosion Analyzer which allowed them to evaluate and predict corrosion rates, localized corrosion, and polarization curves for newly developed alloys under aqueous conditions. The key feature of this solution was the Real-Solution Pourbaix Diagrams—graphical depictions of Eh vs. pH for any mixture of chemicals in water to evaluate corrosion and redox products. According to one research engineer, "The OLI Studio: Analyzer was a game-changing tool that enabled our team to calculate the asset life of new alloys to determine the most viable materials for development."

> "Working with OLI Systems has benefitted us greatly and helped our team to understand the corrosion behavior of alloys under certain conditions. With these rigorous tools, we look forward to gaining deeper insight into corrosion and accelerating materials development."
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> *– Midstream O&G Customer*

OLI Systems drives materials innovation

By implementing the OLI Studio: Corrosion Analyzer, researchers were able to observe the corrosion behavior of a number of high-entropy alloys by determining the effect of different contaminants in addition to comparing their performance with commercial alloys. Furthermore, Pourbaix Diagrams created with the Corrosion Analyzer revealed the ability of certain alloys to resist corrosion linked to carbon dioxide, sodium chloride, and varying pH levels.

Today, the laboratory is developing new high-entropy alloys based on this experimental data. Their efforts are generating never-before-seen insights that promise to equip midstream companies with the ideal operating materials and drive materials innovation in the future. Moving forward, the laboratory plans to share this data with OLI Systems to create an even more comprehensive tool for water chemistry analysis. According to one research engineer, “Working with OLI Systems has benefitted us greatly and helped our team to understand the corrosion behavior of alloys under certain conditions. With these rigorous tools, we look forward to gaining deeper insight into corrosion and accelerating materials development.”