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Corrosion Prediction and Material Selection for Sulfuric Acid Alkylation Units

Product Information Note

Accurately predict and assess the corrosion you cannot see

The Predict®-SA 2.0 Corrosion Prediction Software System encapsulates inferences, experimental results, and research data from comprehensive Joint-Industry Program (JIP) research conducted by Honeywell and sponsored by industry-leading refining and engineering companies entitled, "Prediction and Assessment of Corrosion in Sulfuric Acid Alkylation Systems." The goal of this program was to develop a quantitative engineering database and decision-support model to predict corrosion of carbon steel and corrosion resistant alloys (CRAs) in sulfuric acid alkylation units. The program targeted the relations between corrosion and critical environmental parameters, such as temperature, sulfuric acid, acid soluble oil (ASO) and hydrocarbon concentrations integrated with characterization of flow regimes and wall shear stress for several commonly used alloys in the following three zones.

- Zone A—Concentrated sulfuric acid piping service (fresh, recirculating, and spent sulfuric acid with concentrations from 99.5 wt% down to 87.4 wt%)
- Zone B—Concentrated sulfuric acid reactor/contactor section (emulsion service—approximately 50 vol% hydrocarbon, 50 vol% sulfuric acid
- Zone C—Entrained acid service to the caustic/water wash system (low-level acid carryover in raw alkylate)

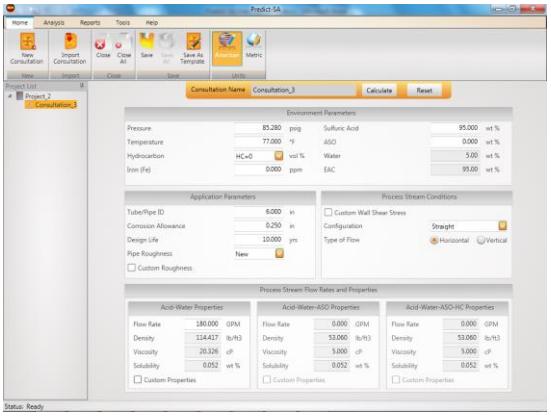

Figure 1: Predict®-SA 2.0 program input interface, showing relevant inputs required for corrosion prediction

BENEFITS

- Effectively characterize and predict corrosion and identify appropriate, resistant material (when carbon steel is not applicable)
- Helps in the development and implementation of Integrity Operating Windows (IOWs)
- Extensive online help assists the user in understanding the significance of different corrosion evaluation parameters and their effects
- Easily perform analysis of complete pipeline with corrosion prediction and flow modeling for horizontal/vertical pipe sections
- Pinpoint parameters contributing to corrosion and assist with development of effective mitigation methods
- Access to extensive consulting and development support from Honeywell International Inc. in using/customizing Predict®-SA

Corrosion Prediction Made Easy

Predict®-SA 2.0 offers an intuitive user interface that takes little time to master and delivers results quickly. The user interface presents the pertinent inputs needed to quantify corrosion in sulfuric acid alkylation units. These inputs are the commonly available process data such as:

- Operating conditions – pressure, temperature and sulfuric acid ASO and hydrocarbon concentrations, etc.
- Application information – pipe ID, corrosion allowance, design life, etc.
- Process stream flow rates and properties

Once the input data is entered, Predict®-SA 2.0 performs an in-depth analysis and generates:

- Predicted corrosion rate for five materials (expressed in MPY or MMPY
    - Carbon Steel – un-welded and welded
    - Alloy 316L
    - Alloy 20 – includes Alloy 20Cb3 (un-welded and welded) and Cast CN7M)
    - Alloy C-276
    - Alloy B-3
- Provided passive and active corrosion rate for 316L and Alloy 20
- Estimated properties for sulfuric acid mixtures – density, viscosity and solubility
- Flow results – flow regime and wall shear stress
- Time-to-failure plot – predicted time to failure based on current corrosion rate

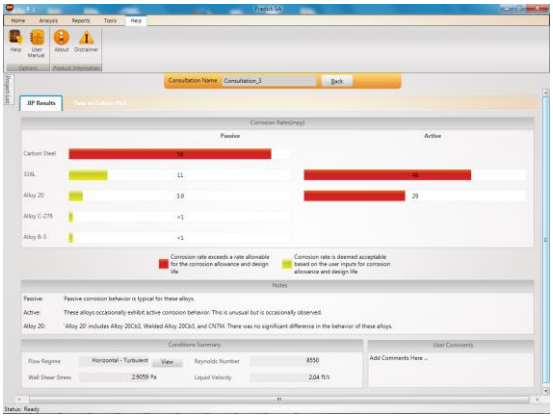

Figure 2: Predict®-SA 2.0 program output interface, showing corrosion predictions

Features

Predict®-SA 2.0 offers the following critical functionality:

- Prediction and assessment of corrosion in sulfuric acid alkylation units as a function of sulfuric acid and ASO concentrations, temperature, and various additional parametric variables
- Provides data for up to five materials ranging from carbon steel to Alloy B-3
- Provides data for active and passive corrosion for two alloys
- Multi-phase flow modeling module correlating key flow parameters and corrosion rates to quantify contribution of typical flow-induced corrosion parameters
- Ability to estimate the density, viscosity and solubility of sulfuric acid mixtures
- Ability to evaluate the effect of iron content and hydrocarbon
- Graphically view service life of pipe using predicted time-to-failure plot
- Study parametric effects with sensitivity analysis tool
- On–the-fly and secure, electronic access to actual laboratory test data and program reports

- Supports generation of extensive data reports, multiple case analyses and data-sharing across platforms
- Extensive Online Help System that guides users to effectively use the software and accurately interpret program results
- Real Time (RT) version of Predict®-SA 2.0 that may be easily linked to Process Historian and DCS

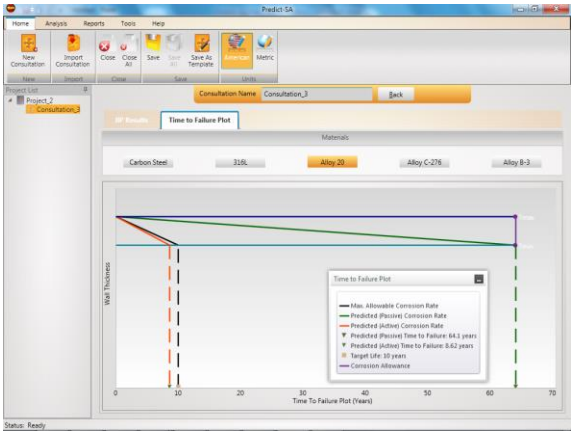

Figure 3: Predict®-SA 2.0 time-to failure plot

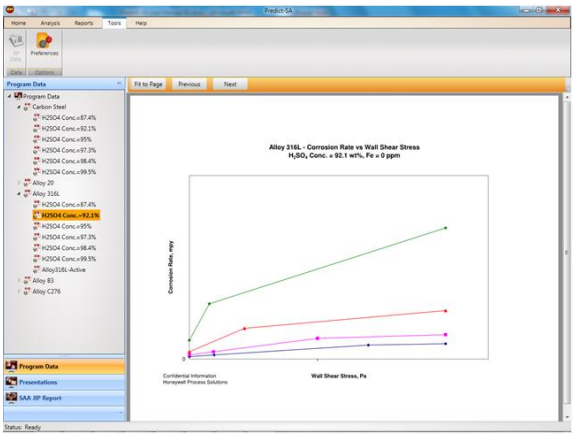

Figure 4: Predict®-SA 2.0 JIP data for Alloy 316L

Secure Access to JIP Data

Users can securely and electronically access the actual laboratory test data and program reports utilized within Predict-SA 2.0 to make predictions.

Predict-SA 2.0 software is the only system of its kind, giving plant operators the ability to quantify corrosion in sulfuric acid alkylation units and plan safe operating procedures. This provides planners and plant managers the ability to make appropriate financial and engineering decisions related to material performance and selection in sulfuric acid alkylation units.

Benefits Guardianship Program

This product comes with worldwide, premium support services through Honeywell's Benefits Guardianship Program (BGP). BGP is designed to help our customers improve and extend the usage of their software applications and the benefits they deliver, ultimately maintaining and safeguarding their software investment.

Honeywell Predict® Corrosion Suite

Honeywell Predict Corrosion Suite provides next generation corrosion management solution or oil and gas and refining industries seeking to move from reacting to corrosion damage to a more proactive and effective approach, Honeywell Predict Corrosion Suite provides the next generation of corrosion management solutions. Unlike conventional corrosion management methods, we employ unique prediction models that encapsulate deep expertise and extensive process data to correlate corrosion rates to specific process units, damage mechanisms, and operating conditions. Using Honeywell's tools, global major companies have achieved significant operational and business benefits.

The Honeywell Predict Corrosion Suite is a unique solution for today's industrial facilities, driving a paradigm shift in tackling difficult corrosion problems, and enabling efficient and safe operations. These software tools help users move away from a reactive response to corrosion based on qualitative, manual inspections, to a proactive, reliability-centric predictive approach based on quantitative information from soft sensors, sound process deviation management, and "what-if" scenario analysis tools.

Why Honeywell?

Your operation can benefit from partnering with a proven leader in corrosion asset integrity and preventive/predictive corrosion management. Honeywell has extensive intellectual property in the corrosion field, including unique corrosion prediction and material selection models, and patented corrosion monitoring technology. Our deep expertise includes an in-house team of experts with decades of experience in developing corrosion solutions. Honeywell's IP-based models are licensed and used by many global oil & gas majors, and our company has a recognized track record of world-class execution of projects.

Honeywell has also established a unique corrosion knowledge community through our Center of Excellence (COE). We assist customers with expert local and remote support. Our state-of-the-art corrosion and materials research and engineering laboratory provides a host of standard and tailored services. Utilized in Joint Industry Programs and customized testing, this facility can simulate any service environment.

For More Information

Learn more about Honeywell's Corrosion Solutions, visit www.honeywellprocess.com/Corrosion or contact your Honeywell Account Manager, Distributor or System Integrator.

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