Product Information Note

Accurate Corrosion Prediction for Carbon Steel in Multiphase Oil & Gas Production or Transmission Systems

Predict® 6.1 is the latest upgrade to the industry-leading corrosion prediction software suite with new features and Microsoft® Windows® 10 compatibility.

CO_2 and H_2S corrosion (termed acid gas corrosion) in oil and gas production environments are key contributors to asset degradation and failure. Accurate quantification of corrosion due to these factors is critical in enabling improved assurance in safe utilization of steels in almost every production unit in oil and gas production and transmission.

Honeywell's Predict software presents a hierarchical approach to assess system corrosivity and facilitates prediction of corrosion rates for carbon steels in production / transmission environments containing CO_2 and/or H_2S. Based on user input data, Predict captures the effects of key critical environmental and operating parameters that influence corrosivity. It further characterizes the effects of these parameters on corrosion rates, utilizing extensive laboratory data, phase behavior models and fluid dynamic characterization.

Corrosion Prediction Made Easy

Predict offers an intuitive user interface that takes little time to master and delivers results quickly. The user interface presents pertinent inputs needed to quantify the relevant production or transmission environment. These inputs are the commonly available environmental and operating factors such as:

- Application or process data (pressure, temperature, gas oil and water flow rates)
- Speciation data (acid gas concentration and water analyses)
- Project data (service life, corrosion allowance, well or stream information)

Once the input data is entered, Predict outputs the following corrosion and water characteristics:

- Predicted corrosion rate, expressed in mpy or mmpy
- Pitting probability
- In-situ pH
- A computed system dew point and water phase distribution
- Quantification of liquid water
- Scaling products and saturation pH

In addition, a multiphase Flow Model enables the user to visualize the flow regime and evaluate the effects of flow occurring in a particular section of a pipe. Applicable to inclined flows for both uphill and downhill flow, the Flow Modeling feature can calculate a two-phase Reynolds Number, a friction factor, and accounts for effects of liquid hold-up and wall shear stress on predicted corrosion rates. Predict incorporates both the environmental (electro-chemical) and fluid dynamic parametric effects on corrosion.

Predict program interface, showing predicted pitting corrosion potential and general corrosion rate for carbon steel

Features

Predict provides a practical prediction of system corrosivity for carbon steel based on available operational parameters. This enables informed financial and engineering decisions built on real material performance data. Predict offers several unique attributes:

- A corrosion prediction system to provide a way to estimate probability of pitting corrosion

- The ionic, pH computation module accounts for the effects of 16 different anion and cation species,

- Rigorous water phase behavior calculations coupled with the ability to account for the effects of glycol (MEG, TEG and DEG)

- Ability to accurately model momentum transfer effects (flow regimes, void fractions, pressure drops and shear stresses)

- Ability to accurately determine scaling effects due to formation of iron carbonate and iron sulfide scales as a function of temperature and pH

- Ability to accurately characterize role of oxygen concentration in corrosive systems

- Improved rules to account for variation of water content in oil and gas systems (production and transmission)

- Quick access to actual laboratory test data encompassing over 18 flow loop tests

- Accurately determine scaling effects due to formation of iron carbonate and iron sulfide
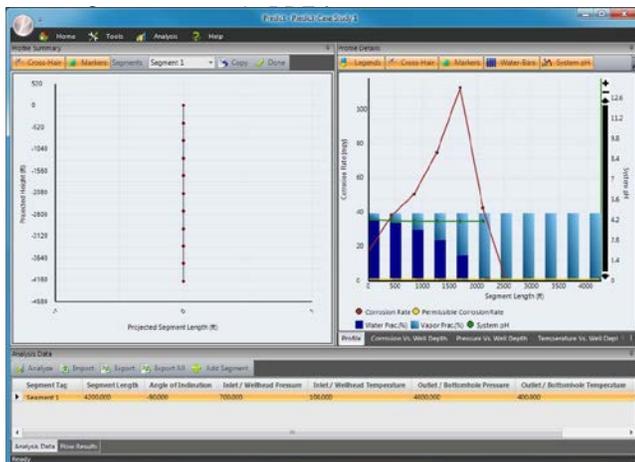
Evaluate pipeline profiles and inlet/outlet bottomhole/wellhead data in Predict

New Enhancements for Predict 6.1

Version 6.1, the latest release of Predict makes corrosion prediction even easier with the following enhancements:

- New pH prediction module that facilitates accurate inlet and outlet condition characterizations

- Accurately determine scaling effects due to formation of iron carbonate and iron sulfide

- Perform advanced flow modeling and correlate wall shear stress effects on corrosion rate from JIP data

- Perform prediction from aqueous CO_2 / H_2S corrosion data

- Characterize water phase behavior from specified dew point

- Perform life cycle cost analysis and graphically view of service life of pipe from predicted time to failure plot

- Evaluate entire pipeline profiles with horizontal, vertical or inclined segments

- Perform Multi-Point Analyses, Multi-Point Sensitivity Analyses and Expert Multi-Point Sensitivity Analyses

- Exchange data seamlessly with other Honeywell Corrosion Models

Benefits

- Evaluate and Predict corrosion for a variety of corrosive environments with acid gases - production, pipelines, power plants, flow lines, gas processing plants

- Accurately calculate operating system in-situ pH with data on system chemistry

- Evaluate CO_2/H_2S corrosion and other parametric interactions

- Predict phase behavior of water in aqueous systems

- Determine the flow behavior and accurately correlate the flow effects

- Graphically view the corrosion profile over an entire pipe / tubing length

- Predict corrosive effects of systems with chlorides, oxygen or sulfur

- Perform comprehensive corrosion and cost characterization for entire systems

Building a Standard Work Process for Corrosion Prediction

The use of a corrosion modeling application like Predict allows a company or site to evaluate corrosion problems consistently and with high accuracy and repeatability. Predict is built upon a multi-faceted, foundation of corrosion knowledge, including proprietary data from hundreds of laboratory tests that constituted a Joint Industry Project (JIP) on Multiphase CO_2/H_2S corrosion extensive literature information, accurate multiphase flow modeling and the industry's most comprehensive database on steel corrosion rates.

Because corrosion in multiphase CO_2 and H_2S systems is an extremely complex phenomenon, the only way to model corrosion is to utilize laboratory test data generated under simulated flowing conditions. The JIP corrosion test conditions incorporate simulated flowing conditions and that data helps in formulation of rules correlating critical parametric relationships. Predict also incorporates rigorous mechanistic models for phase behavior, ionic analyses and flow modeling. This integration of first principles and real engineering data provides Predict the unique foundation to accurately predict corrosion under a range of operating conditions relevant to oil and gas production and transmission systems. The result is that Predict is the only system available today whose numerical model is built upon real H_2S and CO_2 corrosion laboratory testing data integrated with rigorous flow and ionic modeling.

The Predict model also captures the individual and synergistic effects of critical parameters on corrosion rates. The primary environmental variables found to influence corrosivity are those which contribute to acidic pH in production environments (the acid gases, CO_2 and H_2S). Predict uses the system pH as a central factor in modeling mechanisms that contribute

significantly to corrosivity, including the roles of multiple anions and cations, as well as assessing the role of pH in the dissolution and/or precipitation of corrosion product. The inclusion of these fundamental determinates is factored into the output from Predict, which also includes a separate Sensitivity Analysis function allowing the user to see the effect of individual factors like acid gases, acetates and production rates on the predicted pH and corrosion rates.

With an underlying foundation based upon real corrosion research and first principles, Predict uses a practical approach to modeling corrosivity:

- First, provide a predictive model that utilizes commonly available environment and operating parameters

- Second, utilize existing lab data, field data, or theoretical models to obtain realistic assessments of corrosivity and corrosion rates

- Third, include a computational approach that integrates both numerical and heuristic (field data and experience) information and knowledge about corrosivity prediction

Most other predictive models tend to be either very conservative in their interpretation of results or focused on a narrow range of parametric effects; these approaches do not lend themselves to a practical application for predicting corrosivity or corrosion rates for oil and gas field applications where the ability to characterize effects of all the relevant parameters has to be complemented by an accurate basis for doing so. With the foundation in place and confidence in an application built upon rigorous corrosion principles and data, users have built their standard working practice for corrosion prediction on Predict.

For More Information
To learn more about Predict software and our Corrosion Solutions visit our website www.honeywellprocess.com/corrosion or contact your Honeywell account manager.

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