UniSim® Design Suite
Hydroprocessing Reactors

Product Information Note

High fidelity kinetic reactor modules enabling refiners to understand unit behavior and optimize their hydroprocessing results

The Challenge: Process less expensive opportunity crudes while meeting strict specifications for sulfur content

Changes in spot market prices have forced petroleum refiners to re-evaluate their operations in search of greater flexibility. At the same time, various jurisdictions have imposed tighter specifications on the sulfur content of refinery products. This has led to investments in advanced technologies to achieve greater agility in the use of price-advantaged feedstocks, meet strict regulatory requirements, and respond to market fluctuations to maximize margins.

Refinery engineers require solutions to simulate the processing of less expensive opportunity crudes to ensure they meet product specifications while delivering expected economic benefits. They’re also concerned with the impact of changing crudes on unit behavior and catalyst life.

The Opportunity: Produce cleaner refinery products from a wider range of feedstocks

Modern refineries include units to remove sulfur, nitrogen and trace elements from crude oil via a process known as hydrotreating, as well as crack heavy feeds into light valuable products like diesel and...
naphtha via a process called hydrocracking.

Most facilities include at least three hydrotreating units for upgrading naphtha, middle distillates, gas oils, intermediate process streams, and/or residue.

Hydrocracking has emerged as a key production asset for middle distillates in many refinery configurations. This process takes heavy gas oil from the atmospheric tower, vacuum tower, fluid catalytic cracking unit (FCCU), and coking units as a feedstock. These gas oils are heavier than distillate fuel oil, and they also have a higher boiling range. The unit “cracks” the heavy long-chain molecules into shorter chain molecules in the presence of hydrogen and catalyst. The resulting product is a clean-burning diesel, jet fuel, and gasoline.

The Solution: UniSim Design Hydroprocessing Reactors

Honeywell Process Solutions is recognized for providing advanced software solutions enabling customers in refining and other industries to capture and share process knowledge, improve plant profitability, and maximize the return on their technology investments. For example, our UniSim software family substantially improves simulation of online and off-line process unit design and optimization applications. It also helps determine the workflow, equipment needs, and implementation requirements for a particular process.

The UniSim solution is part of the Honeywell Connected Enterprise, which offers products and solutions that connects processes, assets and people to make the most of plant data and process domain expertise.

The UniSim Design Suite provides intuitive process modeling software that enables process engineers at refineries to create steady state and dynamic models for plant design, performance monitoring, troubleshooting, business planning, and asset management. UniSim simulation technology also helps engineers gain the expertise they need to work with a host of complicated refining processes.

Built on the advanced UniSim EO modeling platform: UniSim Design Suite now includes modules representing specific refining conversion reactors. The UniSim Design Hydroprocessing Reactors are one of the latest offerings in the UniSim Refining portfolio. They include the only individual reactor models built from the ground up on the next-generation EvOlution (EO) modeling platform, which solves all equations simultaneously (rather than sequentially) and provides comprehensive, model-wide optimization. The hydroprocessing reactors can be configured within the UniSim EO environment, together with other unit operations. They fit into Honeywell’s overall UniSim refining model with interconnected processes allowing simulation of how one processing unit influences another. The result is a larger, refinery-wide simulation of how to run operations to produce more valuable and salable products.

Leverage proven Honeywell UOP expertise: Validated by pilot plant data from Honeywell UOP, a global leader in advanced refining technology, the UniSim Design Hydroprocessing Reactors provide two

Petroleum refiners are investing in hydroprocessing technologies to achieve greater agility in the use of price-advantaged feedstock.
The UniSim Design Hydroprocessing Reactor software is backed by the domain expertise of Honeywell Process Solutions and leverages the deep insights of Honeywell UOP.

reactor modules that can be employed in multiple hydrotreating and hydrocracking configurations. Three types of hydrotreaters—naphtha, diesel and kero—are available standard from the software’s object palette. Additionally, two types of hydrocrackers—single stage once through and two-stage recycle templates—are standard configurations. Each reactor includes optimization packaged into automated parameter calibration for tuning the reaction kinetics.

With the versatile UniSim Design hydroprocessing solution, refinery engineers can select the most profitable feeds for the hydrocracker based on product yields, hydrogen requirements and catalyst life. They can also determine the optimum total conversion and conversion-per-pass, and identify the best operating strategy to leverage synergies between the hydrocracker and the FCC.

The UniSim Design Hydroprocessing Reactors have the ability to characterize various feeds across a wide range of cut points (25-550 degrees C). They can also simulate quench flow controllers accurately. With these robust reactors, refinery engineers can conduct "what-if" studies to optimize hydrocracking operations and improve their economic performance via high conversion. In addition, the hydrotreater supports olefins saturation for the reactor feedstock.

The Benefits

Expand operational insights: The UniSim Design Hydroprocessing Reactors provide access to crucial KPIs related to hydrotreating and hydrocracking operations in the graphical user interface. They include (but are not limited to) liquid hourly space velocity (LHSV), mass conversion, total quench flows, total hydrogen (H2) consumption, partial H2 pressure, catalyst life, and deactivation rates.

Improve process performance: The UniSim Design Hydroprocessing Reactors employ models which accurately match and predict the performance of hydrotreating and hydrocracking processes. They enable refineries to keep their LP programs up to date utilizing the LP generation tool, which generates LP vectors that can be exported for scheduling and planning purposes.

Ensure greater ease of use: The UniSim Design Hydroprocessing Reactors were specifically developed to meet the needs of refining end users and, in doing so, eliminate the need for expert consultants. They include typical processing scheme templates to reduce the time required for configuration. Refinery engineers can perform reactor calibration based on engineering data or real plant information to tune kinetic parameters using the parameter calibration utility built on the NOVA optimizer. They can also apply kinetic parameter optimization to determine the best-fit model depicting their plant configuration and conditions.

Knowledgeable Support

The UniSim Design Hydroprocessing Reactor software is backed by the domain expertise of Honeywell Process Solutions, which covers all aspects of the refining and petrochemical field. Customers can rely on Honeywell’s Global Technical Assistance Center (GTAC) for the help they need, no matter where they are located.

This product comes with worldwide, premium support services through our Benefits Guardianship Program (BGP). BGP is designed to help our customers improve and extend the usage of their applications and the benefits they deliver, ultimately maintaining and safeguarding their advanced applications.
Honeywell provides a complete portfolio of service offerings to extend the life of the plant and provide a cost-effective path forward to the latest application technology. The services include:

- Standard and customized training
- Consulting
- Model building
- Engineering studies
- Custom thermo/unit operations

Why Honeywell

With over 40 years of worldwide experience in the refining industry, Honeywell provides proven technologies to support a quick and safe refinery start up, and efficient operations. Our solutions enable refiners to meet today's demands in innovative and effective ways, lowering costs while reducing risks, optimizing processes, and maintaining the newest and best infrastructure to support their business and operational needs.

Honeywell Process Solutions is committed to providing a wide range of software solutions for refining and petrochemicals. By combining our best-in-class automation technology with proprietary know-how of plant and process design from Honeywell UOP, we provide the largest portfolio of products and services available to refining companies. This includes solutions for automation & process control, advanced applications, regulatory compliance, and operator performance.

For More Information

Learn more about how Honeywell’s UniSim Design Hydroprocessing Reactors can improve performance, visit www.honeywellprocess.com or contact your Honeywell Account Manager.

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