Parallel Fixed Bed Reactor Fuels Refining Productivity

Figure 1: Each Symyx Parallel Fixed Bed Reactor is equipped with 16 individual quartz reactor tubes that enable high throughput, robust experimentation.

As oil prices rise and regulations mandate the production of cleaner, high value fuels, petrochemical and refining companies are seeking breakthrough catalysts and processes to power their productivity and margins.

"We're seeing a step-change in R&D," says Stephen Cypes, catalysis tools product manager at Symyx. "The trend is to make more, and better, from less, whether it be processing cheaper crudes and biofeedstocks into higher value fuels or discovering optimized catalysts and process conditions that create lower emission fuels using existing refining infrastructure."

Game-changing goals require gamechanging technology, and the Symyx Parallel Fixed Bed Reactor (PFBR) is capable of screening and optimizing catalysts and processes up to 100 times faster than conventional techniques (see Figure 1). The third-generation design builds on over a decade of design work at Symyx Labs and key customer installations.

"In 12 years of use within Symyx Labs, the PFBR platform has run 13 diverse projects and more than 80,000 catalysts," notes Anthony Volpe, vice president of catalysis at Symyx. The PFBR platform at Symyx has been instrumental in hydroprocessing and was also used in work with Celanese to produce a new catalyst for reducing manufacturing costs of vinyl acetate.

Another customer site that has benefited from the PFBR is the combinatorial catalysis laboratory at Instituto Mexicano del Petroleo (IMP), Mexico's national research petroleum institute. This site has used an early version of the Symyx PFBR since 2002. In a recent article, IMP described an analysis of various synthesis methods on acid site generation, nanostructure and reactivity of Mn-promoted WOx-ZrO2 catalysts. The analysis, which was carried out on a 48-channel version of the PFBR, found that the manganese cation stabilizes the tetragonal phase of these catalysts and is instrumental in their catalytic activity.[1]

"We have applied the Symyx PFBR across a series of R&D projects in petrochemical and refining areas," said Dr. J.A. Montoya, director of the combinatorial catalysis laboratory at IMP.

"Thousands of experiments have been performed using this workflow. We have found that this equipment is very robust, versatile and easy-to-use and achieves a very high level of throughput for catalyst development and optimization." The Symyx PFBR is applicable to a broad range of gas-, liquid- and trickle-phase applications in petrochemicals and refining. Various online sampling and analytics enable seamless acquisition and databasing of catalytic results using Symyx Software, which integrates analytical equipment such as gas chromatographers, mass spectrometers and Fourier transform infrared spectrometers with the reactor operation and catalysis conditions. This software environment results in near real-time, enterprise-wide access to catalytic data. The PFBR can also be integrated directly with catalyst synthesis equipment, enabling the full correlation of catalytic phenomenon and synthesis parameters within the Symyx Software environment.

Currently, 18 16-channel modules are in use at Symyx Labs and are accessible for short-term strategic projects on a per-experiment basis through Symyx Research Services. In addition, six 16-channel modules are in use globally by customers within their own laboratories. Symyx is making 16-, 32- or 48-channel versions of the system available to customers (see Figure 2).

The system can be deployed in one of three ways:

- For organizations seeking to outsource catalyst development or process optimization studies for short term, targeted research needs, Symyx Research Services will run experiments on PFBRs at Symyx Labs.
- For organizations that may already have sufficient catalyst synthesis capabilities but are interested in enhancing the efficiency of their systems, a standalone PFBR module can be delivered as a Symyx Tool and implemented within a research group.
- For organizations aiming to enhance catalyst development and process optimization workflows, the PFBR can be delivered as part of a Symyx Tools Integrated Workflow (IWF) that includes Symyx Software for catalyst preparation and automation integration.

The Symyx PFBR has proven invaluable for rapid catalyst development and process optimization within refining and petrochemical applications. Combining the PFBR with other, even-more rapid catalyst discovery and optimization systems, such as the Symyx Screening Pressure Reactor, can result in a powerful discovery engine to fuel step-out R&D needs in an industry where feedstock pricing and margins are highly sensitive to the underlying catalytic processes.

Figure 2: Each Symyx Parallel Fixed Bed Reactor is equipped with 16 individual quartz reactor tubes that enable high throughput, robust experimentation.

Reader Enquires:
Symyx Technologies, Inc.
3100 Central Expressway
Santa Clara, CA 95051

Phone: 408-764-2000
Fax: 408-748-0175

[1] *Hernández, M.L.; Montoya, J.A.; Del Angel, P.; Hernández, I.; Espinosa, G.; Llanos, M.E. Influence of the synthesis method on the nanostructure and reactivity of mesoporous Pt/Mn-WOx-ZrO2 catalysts. Catalysis Today 2006, 116, 169-178.*