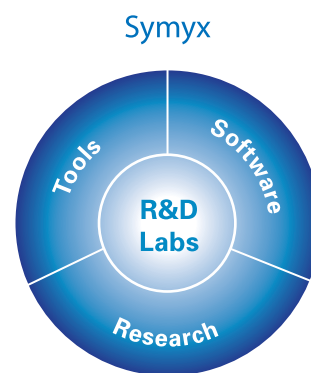


Symyx: Your R&D Integration Partner

Symyx Technologies is a global leader in helping companies maximize the effectiveness and success of their R&D programs. Our unique approach integrates R&D informatics, automation and analysis software, lab automation and scientific know-how. By partnering with us, clients can leverage our industry-level investments in labs, software and tools to improve their R&D execution.

Symyx develops and applies informatics and high-throughput research technologies for the entire R&D process, from early discovery through development to commercialization. Develop more comprehensive data sets around properties of interest that your scientists can model and mine to improve your product attributes. Our clients include over 1,000 companies in the pharmaceutical, chemical, energy, electronics and other industries, including such leaders as Dow Chemical, ExxonMobil, Pfizer, AstraZeneca, Merck and Bristol-Myers Squibb.

...delivering breakthrough results.



Accelerating R&D Certainty

	Tactical	Strategic
Research	Client Directed Research	Collaborative Research
Tools	Benchtop Sample Preparation	Integrated Workflows
Software	Symyx Notebook Symyx Draw Automation Studio Analysis Studio	Enterprise Notebooks Isentris Logistics DiscoveryGate



Heterogeneous Catalysis

Design, prepare, react and characterize new catalysts and final product properties.

Rapidly synthesize and screen new catalysts in your chemistry using high-throughput techniques to explore a large and complex catalyst design and process optimization space. Use technology to build comprehensive data sets around properties of interest that your scientists can model and mine to achieve better product attributes. Characterize catalyst and process performance by measuring catalyst activity, reaction selectivity and conversion.

The Viscous Formulations Workflow gives you maximum flexibility to rapidly discover new catalysts and materials in applications such as:

- Hydrodesulfurization
- Refining Applications
- Oxidations
- Ammoxidation
- Amination
- Hydrogenation
- Halogenation
- Syngas Chemistries
- Other Heterogeneous Catalysis Chemistries

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Symyx Heterogeneous Catalysis Workflows

Combining catalyst synthesis, parallel reactors and rapid analyses in one complete, automated workflow.

Design

Library Editor and Experiment Design

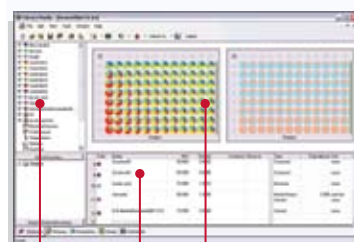
Sources:

- Chemicals
- Precursors
- Supports
- Process Parameters

Recipe:

- Dispensed Amounts
- Mass/Mol Ratios and Loadings
- Parameter Set Points and Automation
 - Solution temperature
 - Drying/calcining conditions
 - Reactor temperature and pressures
 - Reactor feeds and flowrates

Library Studio Software:



Recipe:

Sources: Composition:

Prepare Catalyst Synthesis

Metals Impregnation (MIPS)

- 0.2-1.0 ml catalyst in each well
- Small particles (180-450 μm) or shaped supports (i.e. extrudates)
- Vertical vibration and mechanical mixing
- Aqueous or organic solutions
- Impregnation of 48 catalysts in 30 min
- Drying and calcining with controlled gas flow

Rapid Evaporation/Precipitation

- ~10 mL solution size per vial
- 24 samples in parallel (4 racks with common headspace)
- Temperatures to 120°C, Vacuum to >28 mm Hg
- Vortex 0-1000 RPM

Hydrothermal Synthesis

- 1.5-30 mL reactor size per well (available in multiples of 8 wells)
- Temperatures to 230°C and pressures to 770 psi
- Controlled stirring

Lab Execution Software:



- Single, out-of the box instrument-neutral environment
- Universal instrument, experiment and data control for routine and novel experiments

Co-Precipitation Station (COPS)

- 60 mL volume stirred
- Co-add up to 3 liquids
- Controlled pH
- Ability to mix viscous liquids and age at temperature

Particle Recovery System (PRS)

- Centrifuge-based washing/re-suspension with automated decanting and liquid handling.
- Option for automated dispense of slurry onto substrates for SEM/XRD analyses.

Sample Agglomeration/Sizing (SASS)

- Parallel pelletizing and sizing of solid powders from any of the preparation and synthesis tools listed.
- Various sieve mesh sizes depending on desired reactor for catalysis.

Particle Recovery System (PRS)



Metal Impregnation Station (MIPS)



Process Reaction Screen

HiP/HOSS (High-P Parallel Batch Reactor)

- Pressure to 1200 psi
- Temperature to 400°C
- Automated headspace gas flow and pressure control
- As little as 65 μL catalyst and 1.8 mL liquid per well
- 96, 48 or 24 vials per HiP shell
- Can be integrated with glove-box for inert loading/unloading of catalyst and liquid dispensing

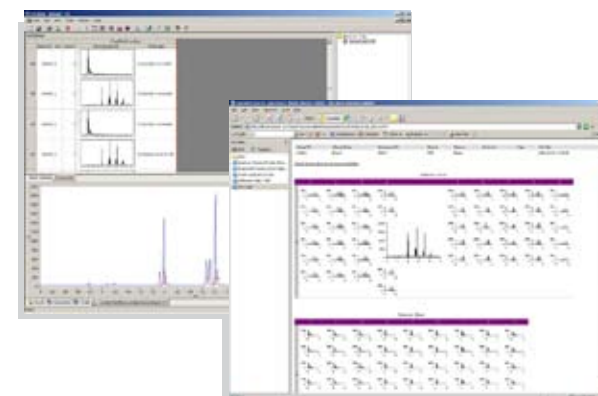
Parallel Fixed Bed Reactor (PFBR)

- Pressure to 2000 psi
- Temperature to 650°C
- 16-channels per module (250 μL catalyst volume per channel)
- Wide range of liquid and gas feed options
- Online GC/FTIR analytical options.

HiP/SOSS (High-P Parallel Batch Reactor)



Polyview Laboratory Analysis Software



Test Material Characterization

Data operations

- Multi-instrument data collection
- Data capture, catalogue and store

Catalyst Analysis

- XRD
- XRF
- TGA

Offline Liquid Reaction Product Analysis

- Core Module-Analytical Prep (Cap/De-Cap) with automated liquid handling and capping/de-capping for sample preparation for desired liquid product analyses
- Parallel Melting/Cloud Point (PMP)
- Antek S/N

Core Module-Analytical Prep (Cap/De-Cap)



Report

Symyx Software

Reports

- Dynamically create tabular reports
- Create report templates for easy re-use

Data Mining

- Query and visualize data
- Examine multi-variant trends and relationships
- Search and retrieve data from both synthesis and screening activities
- Easily export data spread sheet to Spotfire or Excel

Web Reporting

- Save reports as neutral format web pages
- Access data with standard web browser

Web Reporting

