Catalysis research at INL focuses on top energy-consuming chemicals, next-generation catalysts and process technologies.

Improving chemical production

Advanced catalysis research to save energy

Converting biomass to fuels, refining fossil fuels, and manufacturing bulk and specialty chemicals all require energy. In fact, 40 percent of the energy consumed by the U.S. manufacturing sector goes to chemical manufacturing and processing. Idaho National Laboratory researchers are developing novel catalytic processes that use far less energy and water than conventional methods. They also are exploring how chemical production could be integrated with energy production to make both more efficient.

One area of focus concerns improvements to chemical manufacturing processes. INL's experienced scientists and engineers have access to distinctive capabilities for catalyst synthesis, characterization, reaction testing, and modeling and simulation. The lab conducts a range of research projects involving heterogeneous catalysis.

Research areas

INL's catalysis research focuses on top energy-consuming chemicals, next-generation catalysts and process technologies for producing olefins, oxygenates, monomers, polymers and lightweight materials via selective (oxidative) routes. A specific area of interest is oxidative dehydrogenation of light alkanes for the production of ethylene and propylene.

Another distinctive focus area concerns supercritical fluid (SCF) reactions. Experimental work has been carried out with many different SCFs including a wide range of hydrocarbons, oxygenated compounds, chlorinated and fluorinated compounds, and common SCFs like carbon dioxide and sulfur hexafluoride (SF_6). One significant SCF catalyst effort has focused on regeneration of solid alkylation catalysts. Research has emphasized both catalytic conversion of synthesis gas-to-liquid fuels and thermochemical water-splitting cycles for hydrogen production.

Specific capabilities

Catalyst synthesis, characterization, reaction testing, and modeling and simulation tasks

Continued next page

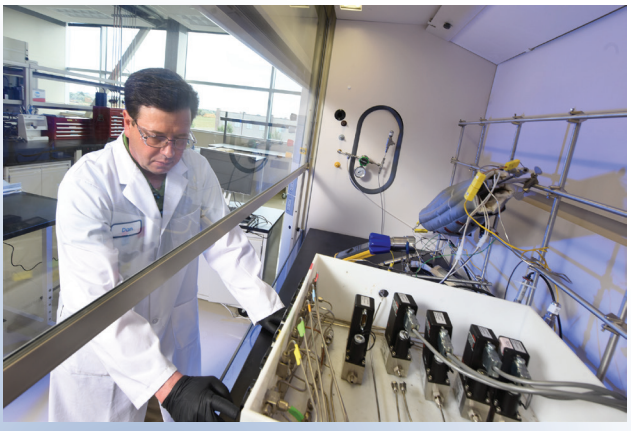
The Energy of Innovation

INL
Idaho National Laboratory

Continued from previous page

are carried out in our modern facilities, which include two laboratories totaling about 2,200 square feet of floor space devoted to catalysis projects.

- Catalyst synthesis equipment capabilities include multiple Parr reactors, bench-top ovens, muffle furnaces and glove boxes.
- Catalyst characterization tools have the ability to operate under pressures ranging from vacuum to more than 500 bar, and under temperatures up to 450° C.
- Catalysis reaction testing abilities can accommodate gas, liquid and supercritical fluid test systems. INL's multiple test systems are rated up to 500 bar, 1,200° C and have flow capabilities ranging from microliters to more than 5.6 liters per minute.
- Plug flow catalysis reactors and continuous stirred tank catalysis reactors span a range of temperatures (up to 1,200° C), pressures (up to 689 bar) and reactor volumes (from microliters to liters).
- A prototype system for scale-up testing has been designed and built at INL to provide syngas at a flow rate of 5 liters per minute and pressure of 96 bar. The automated system includes an integrated Data Acquisition and Control System (DACS) that monitors, logs and controls temperatures, pressures and process stream flows. The DACS also monitors system parameters against safety criteria and activates predefined recovery procedures, if necessary, to preserve safe operating conditions.
- Modeling and simulation tools at INL can address questions ranging from molecular fundamentals to entire chemical plants.



INL scientists have access to distinctive capabilities for catalyst synthesis, characterization and reaction testing

For more information

Daniel M. Ginosar
Project Manager
(208) 526-9049
daniel.ginosar@inl.gov

Nicole Stricker
Research Communications
(208) 526-5955
nicole.stricker@inl.gov

A U.S. Department of Energy National Laboratory