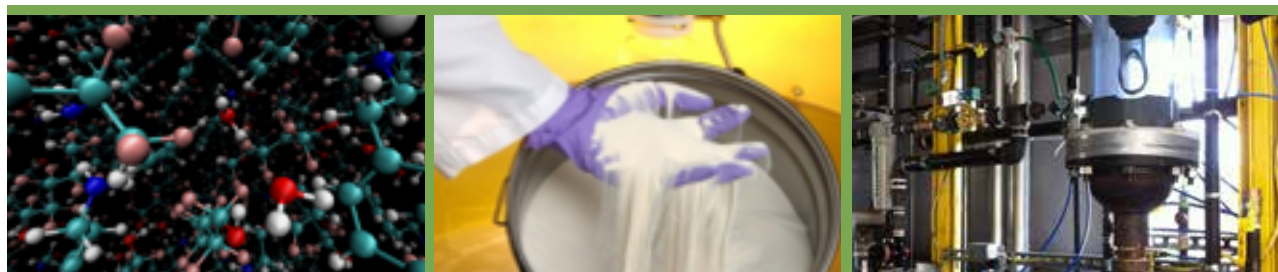


RTI International and PSRI Cooperation: Advancing Innovation in Fluid-Bed Applications



RTI's expertise in process technology complements PSRI's service offering in fluid-bed applications. Our capabilities range from catalyst and sorbent development specifically for fluid-bed processes to "hot" testing on reactive feed mixtures over a wide range of operating conditions. As one of the world's leading independent applied research organizations, RTI supports the development of innovative process technologies in the areas of syngas clean-up and conversion, gas separations, reforming, biomass conversion, and CO₂ capture and utilization.

Our approach focuses on integrated materials and process development, with our core competence being in the rapid development, testing, and scale-up of catalytic materials and sorbents with high activity and attrition resistance required for fluidized beds. RTI can develop process technologies from the early stage to pilot and pre-commercial demonstration.

Catalyst and Sorbent Synthesis

Catalysts and sorbents are integral to RTI's process development activities. For nearly 3 decades, RTI has developed a world-class materials development program and lab facilities. We have experience in developing novel supported-metal catalysts, mixed-metal oxide catalysts, zeolites, attrition-resistant sorbents, and metal-organic frameworks (MOFs). The flexibility of our resources allows for the synthesis of different types of catalysts and sorbents by various techniques—co-precipitation,

impregnation, spray drying, extrusion, and pelletization. RTI has particular expertise in developing highly active and physically strong catalysts and sorbents—properties that tend to be mutually exclusive during development for fast-fluidized or circulating reactor systems. RTI is also one of the few places worldwide capable of producing MOFs at kilogram scale.

The backbone of RTI's materials synthesis program is a large wet-chemistry laboratory that is fully equipped with laboratory- to pilot-scale equipment for the production and optimization of catalyst formulations. Specialized equipment includes a Niro Mobile Minor spray dryer used for spray drying kilogram batches of catalyst or sorbent materials and a Bonnot extruder for preparing catalyst pellets of many shapes and sizes.

Catalyst and Sorbent Characterization

Catalyst characterization facilitates the rapid optimization of catalyst composition and the production process to maximize activity and provide superior physical properties. Our capabilities in catalyst characterization complement our catalyst synthesis program. A wide range of analytical equipment is available, allowing us to effectively evaluate and screen novel catalyst preparations.

Catalyst and Sorbent Testing

RTI has a variety of reactors—including fixed-bed, fluidized-bed, transport, and continuous stirred-tank reactors—that range in size from micro-reactor to 5-inch diameter. These reactors are used to test catalysts and sorbents for their selectivity, activity, and durability. The systems are suitable for rapid screening and long-term testing. We maintain a sophisticated laboratory that allows us to test materials over a wide range of temperatures and pressures and gives us the ability to blend various reactive feed compositions, including corrosive and toxic feed components (e.g., H_2S). Highly automated reactor systems allow for long-term testing, and comprehensive analytical equipment is available for feed and product analysis.



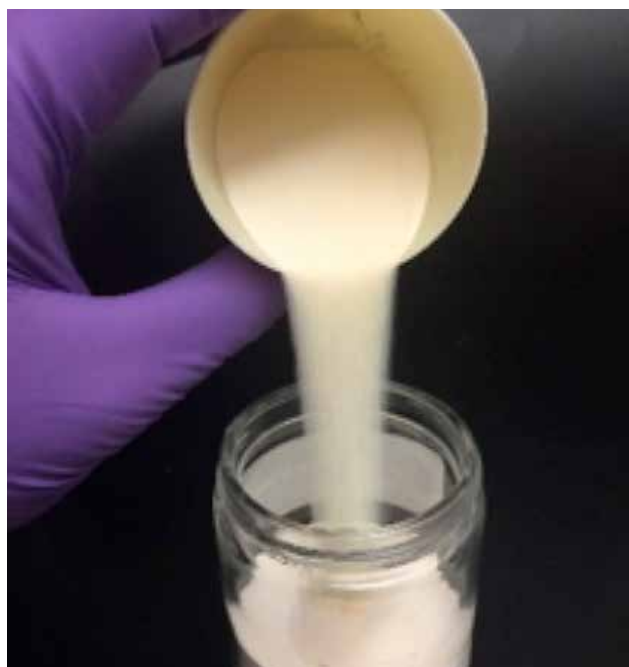
Fluidizable MOF particles

Molecular Modeling and Computational Chemistry

RTI has molecular modeling tools to simulate physical and chemical processes occurring at a molecular level. Molecular simulations can be used to map macroscopic properties to atomistic structure and interactions and to perform in-silico high throughput screening of materials. This computational approach can be used to guide materials development based on macroscopic process requirements. RTI uses the materials processes and simulations (MAPS) platform from Scienomics to run classical/mesoscale simulation codes, like LAMMPS, Towhee, GROMACS, and quantum simulation codes like Abinit, NWChem, and Quantum ESPRESSO.

Materials Scale-Up and Commercialization

RTI maintains a philosophy of adapting commercial and scalable production practices early in the catalyst, sorbent, or membrane development process. We maintain close relationships with the major commercial catalyst manufacturers. This approach results in the straightforward and rapid scale-up of a majority of materials developed at RTI.



RTI's particle heat transfer fluid (pHTF)

Test Systems

- High-pressure, high-temperature reactor systems
- Fixed-bed, fluid-bed, and transport mode
- Lab-scale automated micro-reactor systems for long-term testing
- Pilot-scale biomass conversion unit

Lab-Scale Automated Micro-Reactor Systems

- Multiple micro-reactor test systems 1–10 g catalyst; up to 60 atm; up to 700°C
- Batch liquid product collection and analysis
- Online gas analysis using gas chromatography
- Fully automated
- Ideal for
 - Catalyst and sorbent screening (formulations, operating conditions, activation procedures, passivation procedures)
 - Deactivation studies
 - Catalyst lifetime studies
 - Poisoning studies (concentration and rate)



Lab-scale automated micro-reactor systems

High-Pressure, High-Temperature Fluidized-Bed Reactor

- Temperature: Up to 800°C
- Pressure: 0–300 psig
- Reactor: Fixed- or fluidized-bed
- Simulated syngas mixtures
- Collection and analysis systems for gas, liquid, and solid products

RTI 1-Ton-per-Day Catalytic Biomass Pyrolysis Pilot Unit

- Temperature: Up to 700°C
- Pressure: 0–15 psig
- Solids Feed: 35–150 lbs/hr (biomass)
- Circulating single-loop transport reactor (RTI design with support of PSRI)
- Reactor height: 14 ft., Riser diameter: 2 in.
- Solids circulation (1,000–2,000 lbs/hr)
- Collection and analysis systems for gas, liquid, and solid products



RTI 1-ton-per-day catalytic biomass pyrolysis pilot unit



High-pressure, high-temperature fluidized-bed reactor



Fluid-bed test unit for tar cracking

RTI-PSRI Cooperation: A more comprehensive offering for members and clients

By coupling expertise, RTI and PSRI together can bring a more complete research and development package in the area of fluid-bed technology. PSRI is recognized for its comprehensive fluid-particle applications, including fluidization, solids transport, specialized process and equipment design, application database and design correlations, and large-scale equipment. RTI offers services related to reaction chemistry and catalyst development and brings expertise and capabilities in materials and process development, including fluidized-bed applications for catalyst and sorbent development, scale-up with commercial catalyst suppliers, and innovative process solutions with fluid-bed and transport reactor designs.

Doing Business with RTI

As a contract research organization, RTI works closely with commercial, government, and academic partners. Strategic alliances with industry partners ensure that economic and technical feasibility are part of our thinking from initial concept throughout the development. Joint development arrangements or contract research or service arrangements are possible.

More Information

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