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GTI ENERGY

solutions that transform

CATALYSIS
CAPABILITIES

GTI Energy is where complex energy challenges meet bold solutions. With expertise in energy research, technology development, and business innovation, partners across every sector trust us to build and demonstrate solutions for better-performing energy systems. Guided by systems thinking, collaboration, and innovation, we are focused on driving progress that matters for people everywhere.

Catalysis Capabilities

In-House Lab Facilities

Catalyst Synthesis

- Typical wet lab techniques (IWI, coprecipitation, ion exchange) up to several grams scale
- Simple modification (IWI, ion exchange) up to 1 kg scales
- Crushing and sieving equipment at gram to 1 kg scale
- Hydraulic pellet press
- Glove box and Schlenk line for catalyst synthesis in controlled environments

Characterization

- Gas physisorption (Micromeritics 3-Flex)
  - BET surface area
  - BJH pore size, t-plot, etc.
  - DFT micropore size
- H_2 chemisorption (Micromeritics 3-Flex)
  - Static pressure-based chemisorption
- Pulsed chemisorption, including N_2O
- Temperature-programmed oxidation (TPO), reduction (TPR) or desorption (TPD) with TCD gas detector
- SEM-EDX
- Additional characterization methods supplied by GTI Energy's Analytical Lab (including batch gas and liquid analysis, ICP-OES, gram scale TGA for fixed and volatile carbon analysis)

Catalyst Testing

- Gram scale PFTR testing of catalyst powders
  - 4 x setups
  - 25-1,000 ml/min flow high precision mass flow controllers
  - ~0.1-5 g catalyst testing possible
  - 24/7 operation
  - Catalyst changeover time 1 hour
  - Reactor diameter max. 0.5"
  - Max. P = 700 psi, max. T = 900°C
  - Temperature control by furnace using thermocouple in catalyst bed
  - Online GC-TCD and GC-FID analysis
  - Batch liquid recovery for ex-situ analysis
  - RGA mass spec
- Bench scale PFTR testing of structured catalyst (e.g., extrudates)
  - 200-4,000 ml/min flow high precision mass flow controllers
  - ~100 g - 1 kg of catalyst, appropriate for commercially obtained formed/extrudate catalysts
  - 24/7 operation
  - Reactor diameter ~1"
  - Temperature control by tube-in-tube HX
  - Multiple temperature measurement points along reactor bed
  - Catalyst changeover time 1 day
  - Has recycle capabilities with a recycle gas compressor
- Parr-type batch reactor, (0.5 L, 4 L volume).

Other

- Calcination oven
- Typical catalyst lab equipment (e.g., clean glassware, drying oven, microbalances, heated stir plates, fume hoods)

EXPERTISE

- Typical synthesis and scale-up for catalyst recipe development
- Experiment design, results analysis and interpretation
- Equipment design and consulting
- Experimental kinetic measurement and catalytic kinetic modeling
- Catalyst deactivation measurement and mitigation strategies
- Reactor modeling, design and fabrication
- Ongoing relationships with commercial catalyst manufacturers, toll catalyst manufacturers, academic and national lab catalyst developers
- Knowledge of industrial catalytic processes: typical catalysts and their limitations
- Knowledge of the current academic and patent literature and the current state and trends of catalytic research

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