the ENERGY lab

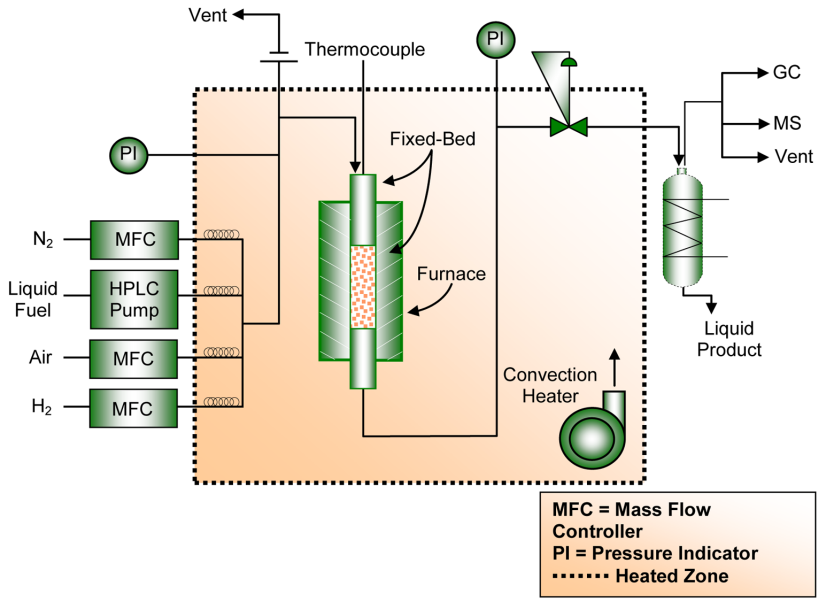
PROJECT FACTS

Separations and Fuels Processing

Fuel Processing / Reforming Research Facilities

Capabilities

The NETL's fuel processing facilities were established to explore fundamental and applied reforming R&D issues that are inherent in catalytic and electro-catalytic unit operations present in fossil-energy related applications. These issues include: reaction kinetics, development of fundamental reaction activity and selectivity scales, mapping catalyst coking regimes, improving sulfur tolerance and understanding their mechanism of poisoning, and catalyst development and characterization. The fuel reforming facilities are comprised of four bench-scale reactor systems, two reforming test rigs (Catalyst Screening Unit and Fuel Processing Unit), one Micrometrics catalyst characterization unit, and state-of-the-art analytical capabilities. These facilities were designed to study several fossil energy related applications such as fuel reforming for fuel cells, coal/biomass gasification, synthesis gas conditioning, synthesis gas cleanup, fuel desulfurization, CO_2 conversion/capture, etc. Furthermore, a variety of feedstocks such as natural gas, methanol, ethanol, Fischer-Tropsch fuels, diesel fuel, biodiesel coal, biomass and their surrogates may be utilized in these facilities. Catalytic materials tested in this laboratory are developed at the NETL or may be provided by external collaborators.



Schematic of Bench-Scale Reactors

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By providing a means to evaluate fundamental and applied fuel processing issues, the fuel reforming facility supports several NETL programs—Solid State Energy Conversion Alliance (SECA) fuel cells, gasification, hydrogen & syngas, and carbon sequestration.

Bench-Scale Reactor Systems

- Four identical high temperature and high pressure fixed-bed reactor systems
- Capability to run in different reforming modes such as autothermal reforming, partial oxidation, steam reforming, and hydrodesulfurization of hydrocarbon compounds and the temperature programmed oxidation and reduction of catalyst samples.
- Reactor outlet streams are analyzed for the permanent gases as well as C1-C7 hydrocarbons using an online mass spectrometer and online gas chromatograph, respectively.
- Two of the reactor systems are designed to operate 24/7 unattended operation.

Reforming Test Rigs

- Capability to run in different modes such as synthesis conditioning and cleanup, autothermal reforming, partial oxidation, steam reforming and hydrodesulfurization of hydrocarbon compounds, and the temperature programmed oxidation and reduction of catalyst samples.
- Reactor outlet streams are analyzed for the permanent gases as well as C1-C7 hydrocarbons using an online mass spectrometer and online gas chromatograph, respectively.
- The Catalyst Screening Unit (CSU) is a multipurpose and versatile research facility and can easily be modified for evaluating the advanced concepts for fuel reforming such as radio frequency (RF)-assisted reforming, temperature profiling of the catalyst bed during exothermic or endothermic reactions, coal/biomass gasification.
- Fuel Processing Unit (FPU), has been designed and constructed for the purpose of testing 5-25 kW fuel processors developed by the National Energy Technology laboratory (NETL) sponsored developers, such as those in the Solid State Energy Conversion Alliance (SECA) program. The FPU may also be used during collaborations with other industrial developers through CRADAs and is designed for 24/7 unattended operation.

Fuel Processing Laboratory with twin-performance reactors, online mass spectrometer and GC's

Catalyst Characterization Unit

- This unit performs N_2 BET surface area analyses, temperature programmed reduction, temperature programmed oxidation, temperature programmed desorption, surface titrations, and chemisorption experiments.
- Effluent gas can be analyzed using an online mass spectrometer

Analytical Tools

- FTIR and FT-Raman coupled
- XRD
- SEM
- ICP
- MS/GC (for < C_{20} liquid hydrocarbon analysis)