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Title:
Transport Reactor Facility

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Disclaimer

CRADA facts

DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

GAS STREAM cleanup PROJECT

TRANSPORT REACTOR FACILITY

Capabilities

The Morgantown Energy Technology Center (METC) is currently evaluating hot gas desulfurization (HGD) in its on-site transport reactor facility (TRF). This facility was originally constructed in the early 1980s to explore advanced gasification processes with an entrained reactor, and has recently been modified to incorporate a transport riser reactor. The TRF supports Integrated Gasification Combined Cycle (IGCC) power systems, one of METC's advanced power generation systems. The HGD subsystem is a key developmental item in reducing the cost and increasing the efficiency of the IGCC concept.

The TRF is a unique facility with high-temperature, high-pressure, and multiple reactant gas composition capability. The TRF can be configured for reacting a single flow pass of gas and solids using a variety of gases. The gas input system allows six different gas inputs to be mixed and heated before entering the reaction zones. Current configurations allow the use of air, carbon dioxide, carbon monoxide, hydrogen, hydrogen sulfide, methane, nitrogen, oxygen, steam, or any mixture of these gases. Construction plans include the addition of a coal gas input line. This line will bring hot coal gas from the existing METC Fluidized-Bed Gasifier (FBG) via the Modular Gas Cleanup Rig (MGCR) after filtering out particulates with ceramic candle filters.

Solids can be fed either by a rotary pocket feeder or a screw feeder. Particle sizes may range from 70 to 150 micrometers. Both feeders have a hopper that can hold enough solid for fairly lengthy tests at the higher feed rates, thus eliminating the need for lockhopper transfers during operation.

If the Entrained Reactor is used alone without the Transport Riser Reactor, it can perform downflow tests under the following conditions:

Temperature: up to 2500 °F (1371 °C)
Pressure: 100 to 960 psig (0.7 to 6.6 MPa [ga])
Residence Time: 2 to 10 seconds
Solids Feed Rate: 0.5 to 10 lb/h (0.23 to 4.54 kg/h)
Gas Feed Rate: 200 to 1000 scfh (5.7 to 28.3 scmh)

If the Riser Reactor is coupled to the Entrained Reactor, upflow tests can be performed under the following conditions:

Temperature: up to 1500 °F (816 °C)
Pressure: 100 to 600 psig (0.7 to 4.1 MPa [ga])
Residence Time: 2 to 10 seconds
Solids Feed Rate: 0.5 to 10 lb/h (0.23 to 4.54 kg/h)
Gas Feed Rate: 200 to 1000 scfh (5.7 to 28.3 scmh)

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Currently, the TRF is conducting nonreacting gas/solid flow studies to characterize the hydrodynamics of the system. Plans call for testing of CMP-107 to characterize single pass sulfidation and regeneration of the sorbent. A synthesis gas mixture representing a KRW air-blown gasifier is planned as the reactant gas.

Opportunities

- Characterize catalytic and noncatalytic gas/solid reaction systems
- Conduct co-current entrained downflow process reactor studies for various gas/solid systems
- Conduct co-current transport upflow process reactor studies for various gas/solid systems

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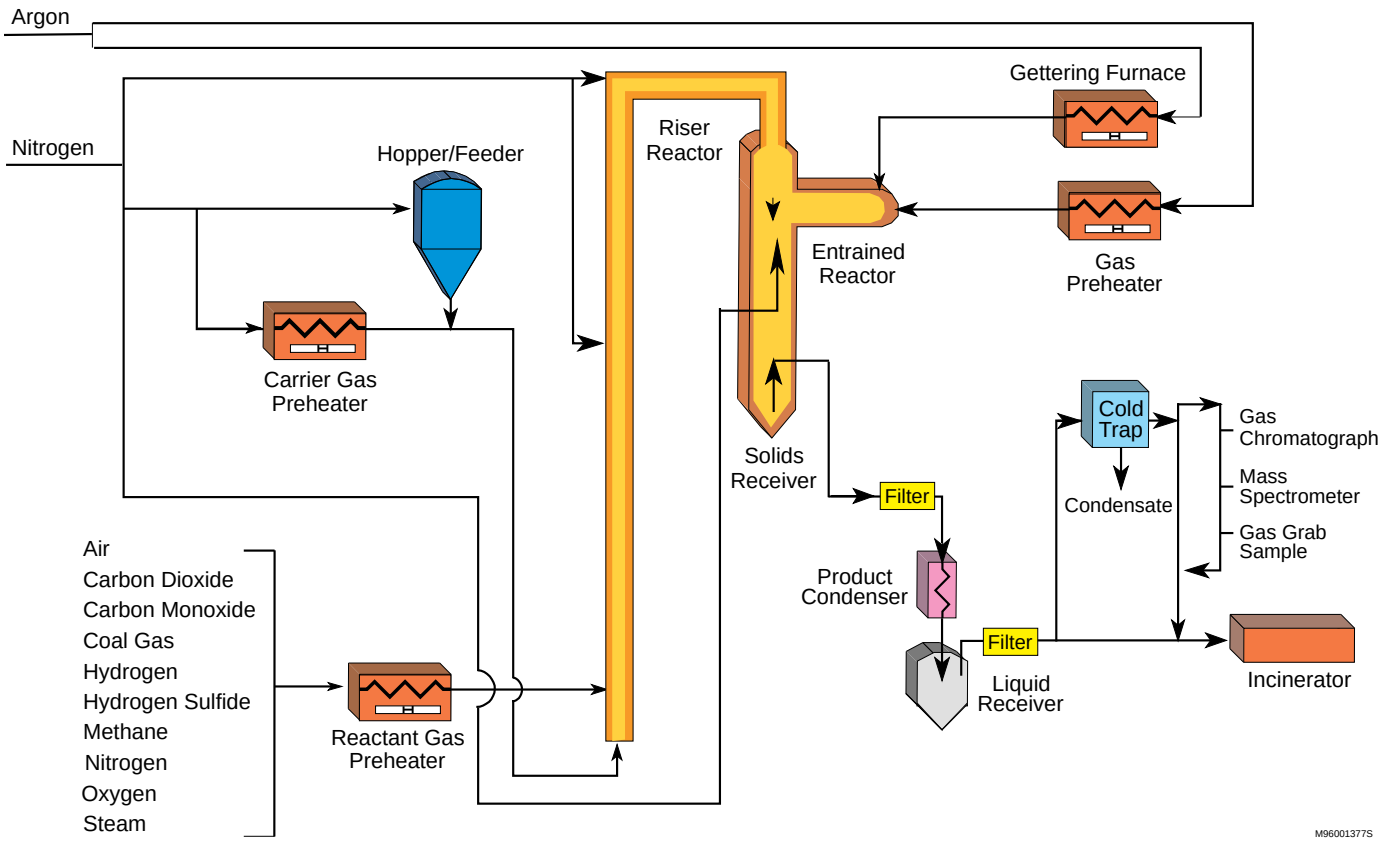

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