



SMALL-SCALE FACILITIES FOR GAS CLEAN UP AND CARBON CAPTURE RESEARCH

Capabilities

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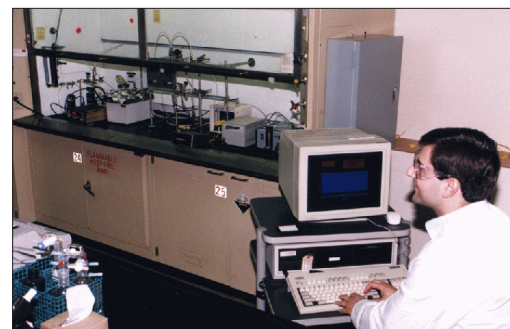
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The Department of Energy's (DOE) National Energy Technology Laboratory (NETL) is conducting research on the cleanup of gas produced either by the combustion or gasification of fossil fuels. This effort directly supports the goal of various DOE technology programs (i.e., Carbon Sequestration, Gasification, etc.) to ensure the continued utilization of coal in an environmentally and economically acceptable manner. Novel technologies are being developed that can abate the air pollutants/components found in produced gas, such as sulfur dioxide, nitrogen oxides, hydrogen disulfide, ammonia, hydrogen chloride, hazardous air pollutants (also referred to as air toxics), and fine particulates and carbon dioxide (CO₂).

Research at NETL has focused on (1) investigating air toxics produced by burning or gasifying various coals, with a particular emphasis on the speciation of mercury and the control of the various mercury species; (2) sorbent-based processes that can remove components from a synthesis gas; and (3) the capture of CO₂ removed from flue gas produced by fossil fuel combustion or from synthesis gas produced by gasification.

Examples of results that can be obtained in NETL's various small-scale reactor facilities include:

- Using thermogravimetric analyzers to investigate adsorption or regeneration kinetics of dry, regenerable sorbents used to remove CO₂ from simulated flue gas or synthesis gas. The large flow of gas over the small charge of sorbent (~50 mg) approximates a differential reactor, facilitating the interpretation of the kinetics by changes in weight.



Data Acquisition System Linked to Synthesis Gas Studies



Solid Sample Being Loaded into Thermogravimetric Analyzer



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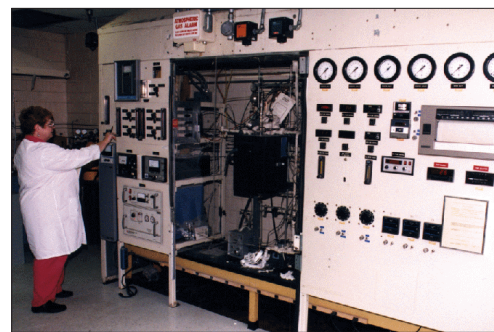
CUSTOMER SERVICE

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- Using packed-bed or fluidized-bed reactors to screen sorbents or sorbent/catalysts for their reactivity toward the removal of certain gaseous pollutants. Continuous emissions monitors that can analyze for the various gas constituents at the reactor exit follow the behavior of the substance of interest. Mass spectrometers also function in this manner.



Packed-Bed Reactor Setup

- Coupling Inductively Coupled Plasma–Atomic Emission Spectrometry (ICP-AES) analysis of difficult-to-measure gaseous pollutants (mercury, arsenic, selenium) with a reactor scheme to screen novel sorbents for the removal of mercury from flue gas.
- Using unique schemes to investigate CO₂ capture: a bench-scale, packed-column scrubbing apparatus to study improved efficiency for wet chemical scrubbing of CO₂ from flue gas.



Packed-Column Wet Scrubbing Apparatus

Opportunities

- Develop kinetic expressions for various gas-solid reactions.
- Screen various sorbents for removal of specific pollutants from flue gas or synthesis gas.
- Characterize catalytic and non-catalytic gas-solid reaction systems by establishing experimental databases.
- Evaluate dry and wet scrubbing techniques for the capture of greenhouse gases.
- Work with industry using the various NETL facilities.