PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Gasification Technologies

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MONOLITH TRAPS FOR MERCURY AND TRACE METAL CONTROL IN ADVANCED GASIFICATION UNITS

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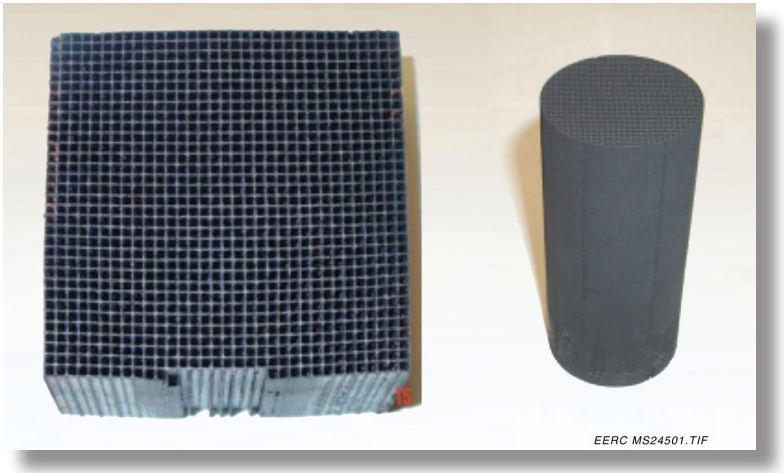
Description

One of the goals of the Department of Energy's R&D effort is the development of ultraclean power plants. In one promising approach, coal is first gasified to produce a syngas that is cleaned to near-zero levels of pollutants, including mercury and other trace metals, before being used to make power, hydrogen or chemicals. Using currently available technologies, the syngas must be cooled before pollutant scrubbing can occur. A process that removes contaminants in one integrated step at a higher temperature would increase the efficiency of the cleanup process, reduce the cost of the cleanup system and, therefore, reduce the cost of ultra-clean, coal-derived electricity.

The University of North Dakota Energy and Environmental Research Center (UNDEERC), in partnership with Corning, Inc., will develop an integrated system to remove the trace metals from coal-derived syngas. Corning has developed a high surface-area, impregnated carbon monolith; UNDEERC has developed a Hg sorbent, functional up to 750 °F. This project will merge these two technologies, and also develop sorbents for other metals (As, Se, and Cd). The monolith is a fixed, honeycomb-like structure that will force the contaminant-laden syngas to travel through multiple small channels. The inside surfaces of the monolith will



Sulfur-impregnated carbon honeycomb monoliths

PARTNERS

University of North Dakota Energy and Environmental Research Center

Corning, Inc.

COST

Total Project Value
$6,243,179

DOE/Non-DOE Share
$4,993,179 / $1,250,000

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be impregnated with the reactive sorbents. The monolith structure is expected to result in high syngas/sorbent contacting, low pressure drop, and a long sorbent life, all of which could result in substantial cost savings compared to the more usual particle sorbent approach to gas cleanup.

The first three years of the project will include monolith preparation, laboratory testing (with synthetic syngas), bench-scale gasification testing (with real coal derived syngas), and pilot-scale gasification slipstream testing. The final two years will consist of construction and testing of a test rig to fully integrate monolith operation and regeneration at a test site able to provide syngas with a pressure of at least 600 psi. Corning is a partner with UNDEERC on this project, providing not only their monolith technology, but also their facilities, expertise and substantial project cost share. Corning will produce the monoliths at their facility in Corning, New York; the monoliths will be tested at the UNDEERC test facility.

Primary Project Goal

The primary goal of this project is to develop a coal-derived syngas cleanup system that is effective in removing Hg, As, Se, and Cd at a temperature between 400 to 700°F and typical gasification pressure in a single, integrated system using a monolith system.

Objectives

The objectives of this project are to:

- Modify the structure, chemical composition, doping profile, and/or flow conditions of the monolith system to reach the following maximum contaminant levels in the cleaned syngas: 5 ppb Hg, 5 ppb As, 0.2 ppm Se, and 30 ppb Cd.

- Demonstrate the monolith system in a pilot system with integrated turbine fail-safe functionality.

Accomplishments

After completion of the first year of lab-scale research this project has achieved the following results:

Decision Point Criteria	Results (**300 psi**)
Hg < 5 ppbw	Met
As < 10 ppb	Met and Exceeded
Se < 0.4 ppm	Met ***at less than 300°F***

(Lab work during the second year will focus on attaining the project decision point criteria at 400°F.)

Benefits

Two major issues for the continued strength and well being of the U.S. are environmental protection and national security. This project will address both these issues by developing a more economical process for reducing heavy metal emissions, which will help ensure that the U.S. can use coal, our most abundant fossil fuel, for ultra-clean power production.