R & D facts

U.S. Department of Energy
Office of Fossil Energy
National Energy Technology Laboratory

Gasification Technologies

12/2006

Multi-Impurity Control from Coal-Derived Synthesis Gas

CONTACTS

Abbie Layne
Director
Separations and Fuels Processing Division
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507
304-285-4603
abbie.layne@netl.doe.gov

George A. Richards
Focus Area Leader
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507
304-285-4458
george.richards@netl.doe.gov

Ranjani Siriwardane
Separations and Fuel Processing Division
National Energy Technology Laboratory
3610 Collins Ferry Road
P. O. Box 880
Morgantown, MV 26507
304-285-4513
ranjani.siriwardane@netl.doe.gov

Background

Coal-derived synthesis gas contains trace amounts of corrosive and toxic contaminants such as H_2S, HCl, NH_3 and trace metals that must be removed before it can be used in turbines, fuel cells, and for chemical co-production applications. These contaminants must be removed to parts per billion levels before the syngas can be used in some of these applications. The current commercial processes require gas cooling that contributes to the loss of thermal efficiency of the process. Therefore, improved processes that can remove the impurities at warm gas temperatures are required.

Primary Project Goal

The primary goal is to purify coal-derived syngas to meet standards for turbine, fuel cell and chemical co-production applications in a cost effective manner; and to minimize the number of impurity removal steps in the process.

Objectives

The objective of this research is to develop technologies to remove impurities from coal-derived syngas to near zero levels so that it can be utilized in various applications such as turbines, fuel cells and chemical co-production. Another objective is to develop sorbents that could remove multiple impurities in a minimum number of steps. Some of the impurity removal targets are listed below.

- Remove total sulfur to less than 60 ppb
- Remove halides to less than 10 ppb
- Fuel bound nitrogen (NH_3, HCN) to less than 10 ppb

Accomplishments

NETL developed a hydrogen sulfide removal sorbent with demonstrated sulfur removal efficiency to below 500 ppb. The sorbent is commercially available from Sud Chemie. This sorbent demonstrated near zero sulfur removal efficiency during tests with real coal gas.

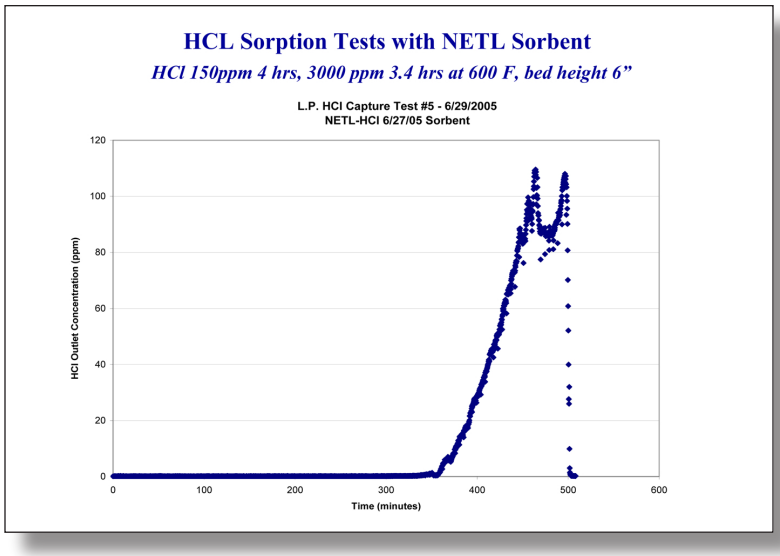
The ability of both regenerable and non-regenerable sorbents to uptake HCl have been evaluated.

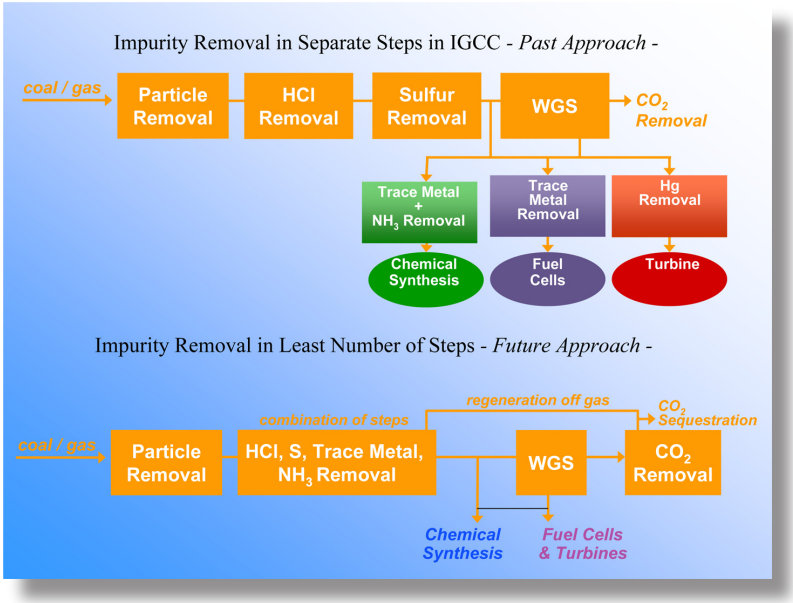
- Bench scale tests using four non-regenerable sorbents showed that the sorbents were able to remove HCl from a gas stream to less than 500 ppb.

- NETL developed a regenerable sorbent for HCl removal that had a removal efficiency to less than 1 ppm. This is the first regenerable sorbent for HCl. A patent application was filed.

Benefits

Development of technologies that can economically produce an ultra-clean coal-derived fuel gas would allow it to be used for fuel cell applications and as a feedstock for some chemical processes where it is not currently suitable. Ultra-clean fuel gas protects downstream plant components from corrosion. Production of ultra-clean coal-derived fuel gas allows its utilization while meeting environmental regulations.





PARTNER

Sud Chemie

ADDRESS

National Energy Technology Laboratory

1450 Queen Avenue SW
Albany, OR 97321-2198
541-967-5892

2175 University Avenue South
Suite 201
Fairbanks, AK 99709
907-452-2559

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
304-285-4764

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4687

One West Third Street,
Suite 1400
Tulsa, OK 74103-3519
918-699-2000

CUSTOMER SERVICE

1-800-553-7681

WEBSITE

www.netl.doe.gov