

PROJECT facts

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

Gasification
Technologies

10/2006



CO-PRODUCTION OF ELECTRICITY AND HYDROGEN USING A NOVEL IRON-BASED CATALYST

CONTACTS

Gary J. Stiegel

Gasification Technology Manager
National Energy Technology
Laboratory
626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236
412-386-4499
gary.stiegel@netl.doe.gov

Patricia Rawls

Project Manager
National Energy Technology
Laboratory
626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236
412-386-5882
patricia.rawls@netl.doe.gov

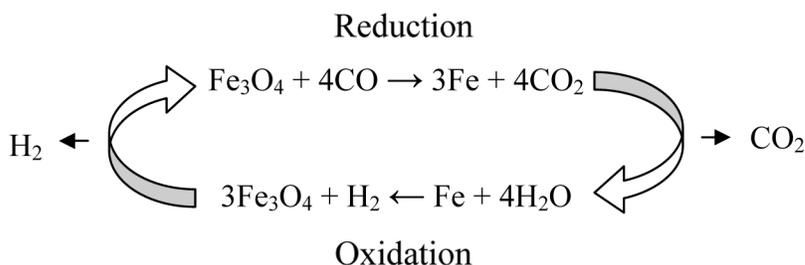
Description

Gasification based technology, such as integrated gasification combined cycle (IGCC), is the only environmental friendly technology that provides the flexibility to co-product hydrogen, substitute natural gas (SNG), premium hydrocarbon liquids including transportation fuels, and electric power in desired combinations from coal and other carbonaceous feedstocks. Our nation has vast reserves of low-cost coal available for gasification. Rising costs and limited supply of crude oil and natural gas provide a strong incentive for the development of coal gasification based co-production processes.

Research Triangle Institute (RTI) in cooperation with the BOC Group and Süd-Chemie Inc. will develop a CO₂ sequestration ready process for the co-production of hydrogen and electricity from coal. This technology will be based on the development of the steam-iron process, using a novel dual-bed fluidized-bed reactor and/or transport reactor system circulation an attrition-resistant iron-based "catalyst" with nanometer sized iron crystallites, between a reducer and an oxidizer. The technology uses the steam-iron redox cycle to produce high purity hydrogen as illustrated below:

PARTNERS

Research Triangle Institute
BOC Group
Süd-Chemie Inc.



COST

Total Estimated Cost
\$3,215,088

DOE/Non-DOE Share
\$2,571,888 / \$643,200

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 Cochran's 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

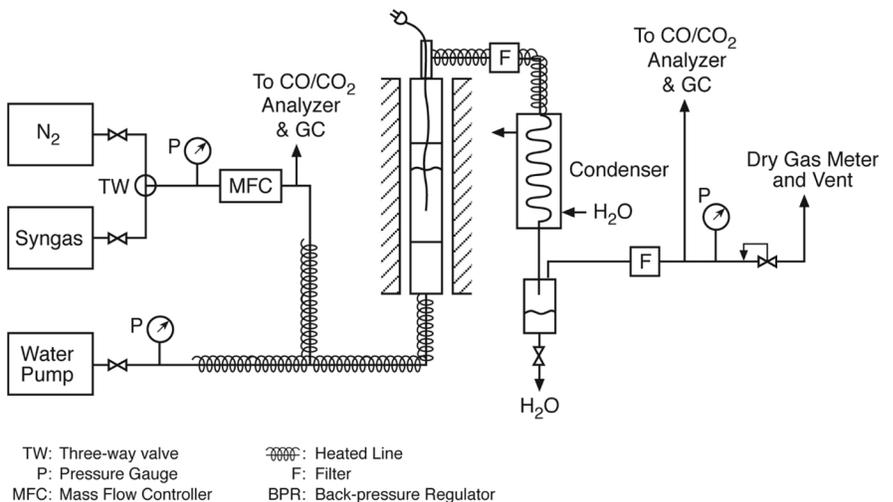
Although the steam-iron process has been known and practiced in the past. It was abandoned due to catalyst degradation and the inability to make the cyclic process truly continuous. Recently, interest has been revived in the process, particularly in Europe and Japan, due to its potential ability to make high purity, high-pressure hydrogen. This project will develop an attrition-resistant nano-particle iron-based "catalyst", on a rugged support, for use in a coupled transport reactor to address the past deficiencies. Preliminary preparation and test at RTI of the nano-particle iron "catalyst" has shown very promising results.

Primary Project Goal

The primary goal of this project is to develop a CO₂ Sequestration ready process for the co-production of hydrogen and electricity from coal using the steam-iron redox cycle.

Benefits

The technology from this project will enable co-production of high purity hydrogen and electricity from an advanced IGCC plant at an economic cost.



Laboratory-scale steam-iron process reactor system