

IV.B.4 Integrated High-Temperature Coal-to-Hydrogen System with CO₂ Separation

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Projected End Date: May 2007

Objectives

- Develop a design for a single module for hot gas cleanup and production of pure hydrogen from coal-derived syngas.
- Develop high-temperature membrane materials.

Technical Barriers

This project addresses the following technical barriers from the Hydrogen Production section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- L. Durability
- M. Impurities
- N. Defects
- O. Selectivity
- P. Operating Temperature
- Q. Flux
- S. Cost

The project also addresses one or more of the barriers described in Section 5.1.5.1., Technical Barriers – Central Production Pathway in the Hydrogen from Coal – Research, Development, and Demonstration Plan of the DOE Office of Fossil Energy.

Technical Targets

The table below lists some of the targets that the project will attempt to meet during its implementation. The project is developing reverse selective microporous ceramic membrane materials for separation of carbon dioxide from hydrogen.

Table 1. Hydrogen Separation Technical Targets^a

Performance Criteria	Units	Current Status (Microporous)	2007 Target	2010 Target	2015 Target
Flux	ft ³ /hour/ft ² / 100 psi P	100	100	200	300
Temperature	°C	300-600	400-700	300-600	250-500
Cost	\$/ft ²	150-200	150	100	<100
ΔP Operating Capability	psi	100	100	Up to 400	Up to 800 to 1,000
Hydrogen Purity	% of total (dry) gas	90-98%	95%	99.5%	99.99%
Stability/Durability	years	–	3	7	>10

^a "Hydrogen from Coal RD&D Plan, External Draft for Review, June 10, 2004," www.netl.doe.gov/coal/fuels/refshelf/pubs/MYRDDP.pdf

Approach

The project commences with the development of a design for a single module for hot gas cleanup and production of pure hydrogen from coal-derived syngas. The development of high-temperature membrane materials is at the core of the design. The process integration concept within this project will combine shift reactors with a high-temperature carbon dioxide-selective membrane to convert carbon monoxide to carbon dioxide, remove sulfur compounds, and separate the carbon dioxide in a compact, fully integrated system, producing high-purity hydrogen.

Accomplishments

This project is newly initiated and there are no accomplishments to report to date.