

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



SOLID SORBENTS FOR CO₂ CAPTURE FROM PRECOMBUSTION GAS STREAMS

Background

According to the President's Global Climate Change Initiative as described in NETL's carbon sequestration technology roadmap and program plan, CO₂ capture from coal gasification systems is critical for the Department of Energy's CO₂ sequestration program. Current commercial CO₂ capture technology is expensive and energy intensive. In addition, most of the techniques require gas cooling for CO₂ capture, which contributes to the loss of thermal efficiency. It is important to develop low-cost processes that utilize materials with high CO₂ adsorption capacity, high selectivity for CO₂, high diffusivity, high rates of adsorption, and high rates of regenerability.

Primary Project Goal

The primary goal of this research project is to develop regenerable sorbents that can capture CO₂ from high-pressure gas streams from such sources as coal gasification systems and are superior to existing commercial technologies.

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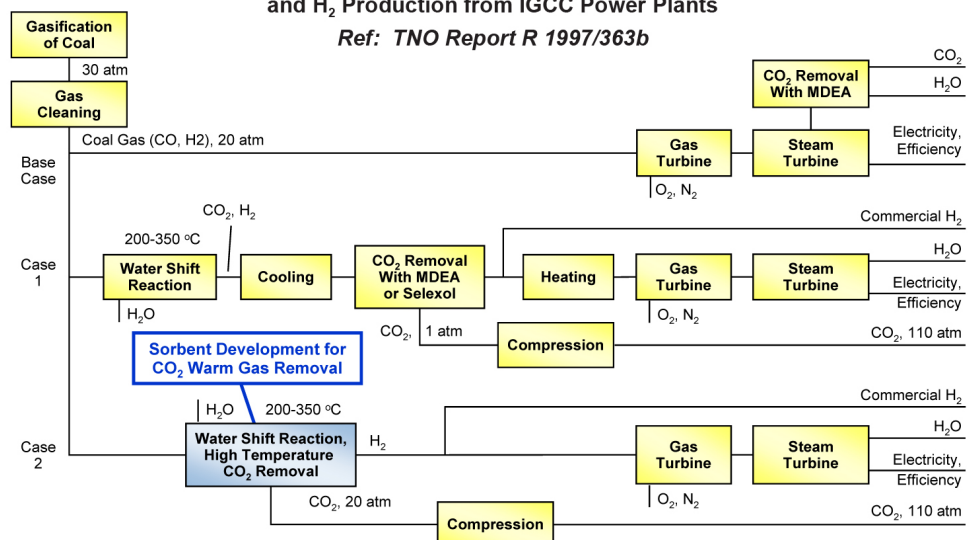
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Comparison of Different Options for CO₂ Removal and H₂ Production from IGCC Power Plants
Ref: TNO Report R 1997/363b



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PROJECT PARTNERS

Süd-Chemie Inc. (Louisville, KY)

Carnegie Melon University
(Pittsburgh, PA)

COST

Total Estimated Cost
\$25,000 per year

ADDRESS

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Objectives

The major objective of this work is to develop solid regenerable sorbents that have high rates, selectivity, high regenerability, and high sorption capacity for precombustion CO₂ capture. Specific objectives include:

- Develop regenerable sorbents that operate at higher temperatures suitable for CO₂ capture from precombustion gas streams, such as those from Integrated Gasification Combined Cycle (IGCC) systems.
- Conduct a complete system analysis incorporating sorbent-enhanced water-gas shift reaction.
- Test and evaluate the feasibility of utilizing the sorbent for sorbent-enhanced water-gas shift reaction.

Accomplishments

- Regenerable sorbents that can capture CO₂ at water-gas shift reactor temperatures were successfully developed.
- High pressure CO₂ capture and high pressure regeneration were demonstrated.
- A U.S. patent for the NETL-developed, high-temperature CO₂ capture sorbent has been awarded.
- The evaluation of zeolites for higher-temperature applications was completed and the good CO₂ capture capacity at 120 °C observed. Process optimization studies and model development with zeolites were completed in collaboration with Carnegie Mellon University.

Benefits

Development of a cost-effective CO₂ capture technology suitable for coal gasification systems is necessary to achieve the President's Global Climate Change Initiative without increasing the cost of electricity from coal.

