PROJECT facts

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

Sequestration

11/2002

Unminable Coalbeds & Enhancing Methane Production Sequestering Carbon Dioxide

Background

One method for sequestering carbon dioxide (CO_2) is to store it in natural geological formations, such as unminable coal seems. Most of the gas present in coal seams is stored on the internal surfaces of the organic matter. Because of its large internal surface area, coal can store 6 to 7 times more gas than the equivalent volume of a conventional gas reservoir. Most coal seams contain methane, the gas content generally increases with coal rank, depth of the coalbed, and reservoir pressure. Unmineable coalbeds are attractive targets for sequestration of CO_2 because they have a large storage capacity and the sequestered CO_2 can enhance the recovery of natural gas by displacing the methane that is present in the coalbeds.

Oklahoma State University is leading an effort to investigate and test the ability of injected carbon dioxide to enhance coalbed methane production. The specific focus of this project is to investigate the competitive adsorption behavior of methane, CO_2, and nitrogen on a variety of coals. Measurements are focused on the adsorption of the pure gases, as well as mixtures. Data will be taken on coals of various physical properties at appropriate temperatures, pressures, and gas compositions to identify the coals and conditions for which the proposed sequestration applications are most attractive.

Mathematical models are being developed to describe accurately the observed adsorption behavior. The combined experimental and modeling results will be generalized to provide a sound basis for performing reservoir simulation studies. These studies will evaluate the potential for injecting CO_2 or flue gas into coalbeds to simultaneously sequester CO_2 and enhance coalbed methane production. Future computer simulations will assess the technical and economic feasibility of the proposed process for specific candidate injection sites.

Primary Project Goal

The overall goal of this project is to develop accurate prediction methods (models) for describing the adsorption behavior of gas mixtures on coal over a complete range of temperature, pressure, and coal types.

Accomplishments

Several types of coals were characterized by their ability to adsorb nitrogen, methane, and CO_2. The low pressure adsorption of CO_2 and methane was studied in a volumetric apparatus. Significant progress in improving the predictive capability of the models has been made. The research will eventually determine how much methane is displaced by a given amount of CO_2.

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UNMINABLE COALBEDS & ENHANCING METHANE PRODUCTION SEQUESTERING CARBON DIOXIDE

PROJECT PARTNERS

Oklahoma State University

Penn State University

Geo-Environmental Engineering
State College, PA

COST

Total Project Value	$674,980
DOE	$624,078
Non-DOE Share	$ 56,125

Objectives

Proposed fourth year milestones

- Measure pure methane adsorption on three different coals and dry activated carbon.
- Develop and validate reliable, simple, analytic models capable of describing multi-layer adsorption.
- Further evaluate the vapor/liquid equilibrium analog model for possible prime candidate for use in CBM and CO_2 sequestering simulators.
- Study the adsorption of binary and ternary gas mixtures.

Benefits

This project will significantly enhance our understanding of multilayer adsorption of near critical and supercritical components on heterogeneous surfaces. The data and models developed will permit evaluation of the ability of coal to sequester CO_2, a major greenhouse gas, and simultaneously increase the supply of methane, a clean-burning energy source, and provide a sound basis for commercial implementation of this technology.