DOE/PC/92521--T117

TECHNICAL REPORT
September 1, 1993 through November 30, 1993

Project Title: **REMOVAL OF PYRITE AND TRACE ELEMENTS FROM
WASTE COAL BY DISSOLVED-CO₂ FLOTATION AND
CHELATING AGENTS**

DOE Grant Number: DE-FC22-92PC92521 (Year 2)
ICCI Project Number: 93-1/5.1B-3
Principal Investigator: S. Y. Shiao, Babcock & Wilcox Company
Project Manager: Dr. Ken Ho, ICCI

ABSTRACT

In dissolved-CO₂ flotation, ultrafine bubbles are generated by CO₂ dissolved in water. The ultrafine bubbles have the potential to improve the separation efficiency in fine coal cleaning. Chemicals will be used prior to or during dissolved-CO₂ flotation to improve the separation efficiency of pyrite and other minerals including trace metals from coal. Chelating agents will be applied to clean coal to further reduce the trace metals from coal.

During this period, the project planning has begun. A 3"-diameter packed column has been ordered. This column will be modified for use in dissolved-CO₂ flotation. Clean and waste coal samples of Illinois No. 6 coal have been scheduled to be picked up from Ohio Coal Testing and Development (OCTAD) facility.

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OBJECTIVES

The objectives of the project are to 1) modify the surface of fine/ultrafine Illinois No. 6 precleaned and waste coal to increase the difference in hydrophobicity of coal, pyrite, and mineral matter, 2) use ultrafine bubbles generated by dissolved- CO_2 to enhance the removal of ash, pyrite, and trace metals from coal in froth flotation, and 3) apply chelating agents on the coal from the froth product to further remove trace metals from coal.

INTRODUCTION AND BACKGROUND

In coal flotation, the separation of pyrite and other mineral matter from coal depends on the relative size of the bubbles to the particles and the difference in hydrophobicity (water-repelling) of the surface of mineral matter and of the coal.

For physical fine coal cleaning, fine bubbles have the advantages of 1) greater number of bubbles, 2) more bubble surface area, and longer bubble life time than large bubbles. The result is more contact between bubbles and particles.

In dissolved- CO_2 flotation, ultrafine bubbles with diameters of about 100 to 200 microns can be generated by first dissolving CO_2 in water under pressure prior to flotation and releasing pressure during flotation. The ultrafine bubbles have the potential to improve the separation of pyrite and other mineral matter from coal.

Chemicals can be applied to the coal surface to increase the differences of hydrophobicity between coal and the mineral matter. When coal is more hydrophobic, more bubbles tend to attach the surface. As a result, the coal tends to float. When the mineral matter in coal is more hydrophilic (water-liking), less bubbles tend to attach to the surface. As a result, the mineral matter tends to settle. Therefore, the separation efficiency of mineral matter from coal is improved.

The new amendments to the Federal Clean Air Act have focused attention on air toxics. The trace elements in coal are the potential sources for some of the air toxics. It has been reported that a large portion of trace elements is incorporated with mineral matter in coal. Removal of mineral matter from coal can also reduce the trace elements in coal. Chelating agents can be applied to coal and react with the trace metals to form complexes. Chelates have the potential to further reduce the trace metal contents in coal.

CONCLUSION AND RECOMMENDATION

The project was just started. It is too early to have any conclusion and recommendation.

PROJECT MANAGEMENT REPORT
September 1, 1993 thru November 30, 1993

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COMMENTS

Although the formal contract has not been executed, B&W initiated the project planning at B&W's risk. B&W expects to complete this project by the current end date, and at this stage of the project there are no significant issues to report.

11/30/93

COSTS BY QUARTER

Removal of Pyrite and Trace Elements from Waste Coal by Dissolved- CO2
Flotation and Chelating Agents

Months and Quarters

O = Projected Expenditures \$0

△ = Estimated Actual Expenditures \$1,008

Total Illinois Clean Coal Institute Award \$88,279

DATE

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END