Industrial Technologies Program

Development of an Advanced Fine Coal Suspension Dewatering Process

Novel Hybrid Vacuum-Pressure Process Increases Coal Recovery and Reduces Process Energy

Advanced fine coal cleaning techologies such as column flotation have seen poor adoption rates in industry. These processes produce a slurry containing 25% fine coal (~35 microns). Vacuum drying can reduce the water content to only 25-30%. A second thermal drying stage is needed to extract water in capillaries within the filter cake to make a usable product containing less than 20% moisture. This drying stage is energy intensive. Dewatering of fine coal slurry constitutes a significant portion of the total cost of cleaning fine coal. When fine coal cannot be successfully dewatered, it is often discarded, representing a substantial loss of energy.

Both vacuum and pressure treatment for dewatering of fine coal have been used previously in industry. However, the two processes have not yet been succesfully combined. Current research at the University of Kentucky indicates that a two-stage process combining both vacuum and high pressure treatment can produce usable fine coal with less than 20% moisture.

Researchers have found that filter cakes formed under vacuum have a porous structure, and that when high pressure is applied, up to half the contained water is released from capillaries within the cake. They have also demonstrated that the process is even more efficient when the cake is broken up mechanically before being pressure treated.

A two-stage vacuum-pressure treatment process offers a promising pathway for producing fine coal containing less than 20% moisture. This process will increase recovery of fine coal, thus saving the energy that would be lost if fines were discarded. Also a major energy and environmental savings comes from the elimination of coal drying, which is energy intensive and contributes fine particles to air pollution resulting in a safety hazard. Lower moisture content of fine coal will also lower the transportation cost per ton by moving more coal and less water from mines to power plants.

The advanced fine coal suspension dewatering process being developed is expected to meet the following requirements:

- Provide an efficient and low-cost dewatering process for ultra-fine coal slurries
- Eliminate the need for thermal coal drying
- Develop basic understanding of the morphology of fine coal filter cakes
- Reduce the mositure content of fine coal filter cake to less than 20%
- Lower transportation costs by reducing the water content of fine coal

Benefits for Our Industry and Our Nation

- *Increases coal available to electric power plants by 0.8% by providing a useful product from coal fines which are now often discarded*
- *Allows 30% reduction in moisture content of fine coal filter cake*
- *Eliminates coal drying, resulting in a 25% reduction in energy consumed by the dewatering process*
- *Increases use of recycled plant process water by removing up to 99% of slurry particles from process water*

Applications in Our Nation's Industry

Dewatering of fine materials is a process common to other facets of the mining industry including aggregates, industrial minerals, and metals. This process could have applications in other industries where large quantities of fine materials are separated from water.

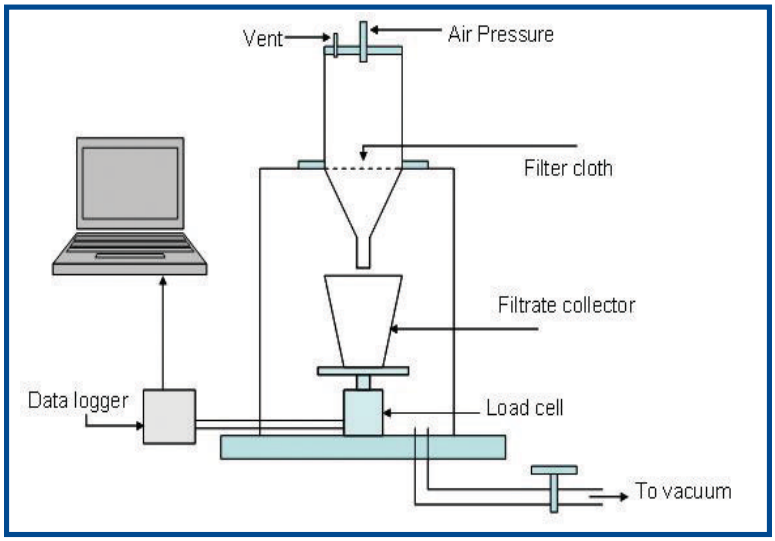
Project Description

Goal: To develop and optimize a process for dewatering of fine coal to improve coal recovery and reduce the energy used in coal processing.

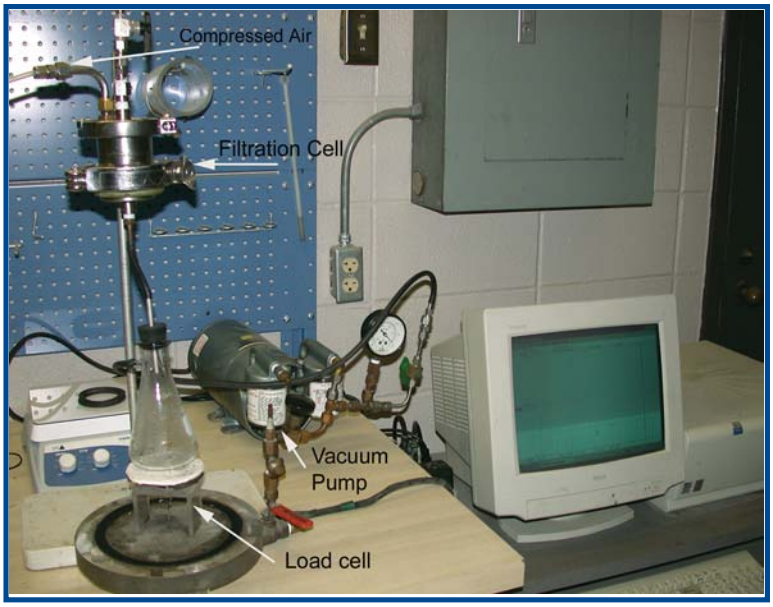
Since the new hybrid process combines two operations that are already common in the industry, adoption of this technology is expected to be relatively swift. Capital expenditures and operational issues will be minimized by the use of familiar equipment and procedures.

Milestones

- Collect and characterize samples of fine coal slurries from at least two different industrial preparation plants
- Optimize the dewatering process through laboratory studies of vacuum and pressure filtration processes
- Develop a concept design of a continuous dewatering unit with preliminary economic and technical evaluations



Schematic diagram of laboratory filtration unit



Actual laboratory filtration unit

Project Partners

University of Kentucky
Lexington, KY

Consol Energy Inc.
Pittsburgh, PA

Peabody Energy
St. Louis, MO

James River Coal
London, KY

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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