Industrial Technologies Program

Development of an Ultra-fine Coal Dewatering Technology and an Integrated Flotation-Dewatering System for Coal Preparation Plants

New Dewatering Technology Will Lead to Decrease in Wasted Coal and Diesel Consumption

Water has been used in mining for a number of purposes such as a carrier, washing liquid, dust-catching medium, fire-retardation medium, temperature-control medium, and solvent. When coal is cleaned in wet-processing circuits, waste streams containing water, fine coal, and noncombustible particles (ash-forming minerals) are produced.

In many coal preparation plants, the fine waste stream is fed into a series of selection processes where fine coal particles are recovered from the mixture to form diluted coal fine slurries. A dewatering process is then needed to reduce the water content to about 15%-20% so that the product is marketable. However, in the dewatering process currently used in coal preparation plants, coal fines smaller than 45 micrometers are lost, and in many other plants, coal fines up to 100 micrometers are also wasted.

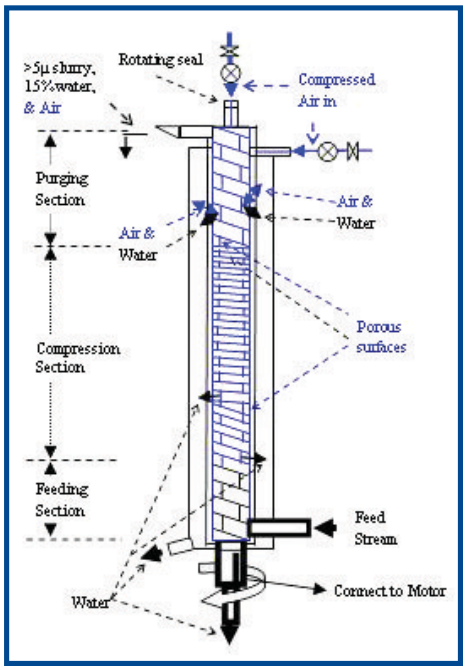
Coal with smaller particle sizes are of greater value as power plant fuel due to their higher purity and larger surface area. Coal fines of a particle size between 5 to 45 micrometers are not available in the U.S. and international markets, because they are wasted in the current dewatering processes.

Researchers at West Virginia University are proposing to develop a dewatering technology that retains coal particles greater than 5 micrometers in size. The dewatering extruder apparatus consists of a stator and a rotator. The stator and the rotator form an enclosure of space in which coal slurry will be pumped through while dewatering takes place.

The surface of the stator and the rotator that form the enclosure are at least partially covered with a porous surface acting as the dewatering filter. Water is expected to pass through the openings of the filter and drain through the channels connected to these openings on the other side of the porous surface.

The process will be designed to accept coal slurry with 50-90% water content from flotation process, one of the selection processes used in many relatively advanced coal preparation plants. The output from this dewatering process will be purer water and coal fine (>5 micrometer) slurry with a water content of about 15%-20% or less.

Low water content products save energy in transportation and water evaporation processes, which are necessary steps for most industries.



The Conceptual Sketch of a Dewatering Extruder

Benefits for Our Industry and Our Nation

- *A 1% increase in coal fines in the range of 5-45 μm, which is equivalent to offsetting 8-10% diesel fuel consumption*
- *Energy reduction due to reduction in evaporation processes*
- *Significantly clearer water resources once coal fines of 5 micrometers and greater are removed*

Applications in Our Nation's Industry

The proposed technology could be used in the medical, food, chemical, and in particular, mining industries. Coal in finer size should also be more favored by other industries in making higher value products, such as nano-tube, chemical agents, or used directly as filler of plastics.

Project Description

Objective: To develop a dewatering technology and system for which a special extruder with filters will allow water/coal fine separation. This project will establish a new, efficient and low-cost process for coal preparation plants, by which very fine coal can be recovered and "dewatered" so that it can be used as power plant fuel.

A dewatering process actually consists of two steps: the separation of solid particles from the water continuous phase, and the subsequent drainage of water from pores formed by the continuous phase of solid particles. In the Phase I effort, West Virginia researchers developed an experimental model with which four dewatering strategies were tested individually and in combined forms. The four strategies are:

1) hydrophilic dispersing flow of water through porous media (filtration) with high wettability to water;
2) pressure flow of water through filtration;
3) agitation of the coal cake/coal slurry to promote water-coal separation
4) air purging to enhance the release of trapped water in coal cakes.

A special pressurized ultra-filtration-extrusion apparatus will be constructed to realize the proposed tests.

Integration of the Dewatering and Flotation Processes

Milestones

- Design and construct the dewatering extruder
- Integrate the dewatering and flotation processes
- Test the research concept with the integrated system
- Conduct study on enhancing the lifetime of the dewatering extruder

Project Partners

West Virginia University
Morgantown, WV

Luscar Ltd.
Edmonton, Alberta Canada

McLanahan Corp.
Hollidaysburg, PA

DeVall Bros. Inc.
Morgantown, WV

Mineral Technologies International, Inc.
Morgantown, WV

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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