

## DYNAMIC CYCLONE CLASSIFIER PROCESSES SOFT CERAMIC PARTICLES AT FRONT END

### BENEFITS

- Could save 185 billion Btu of natural gas per installation annually
- Could save 13 trillion Btu annually in the mining industry by 2010
- Could divert from landfills 8410 tons of calcined kaolin annually per plant
- Lowers lifetime operating costs by reducing component erosion
- Prevents particle attrition by eliminating classification vanes
- Produces sharper cut sizes, improving product quality
- Reduces process and product waste streams

### APPLICATIONS

Dynamic cyclone classification is applicable to industrial powder manufacturers, particularly in the mining and chemical processing industries and also in the pharmaceutical, food, and pulp/paper industries. This new technology will target the replacement of inefficient or ineffective air classifiers, cyclones, and vibratory sieves as well as a small percentage of new market sales for industrial separators.

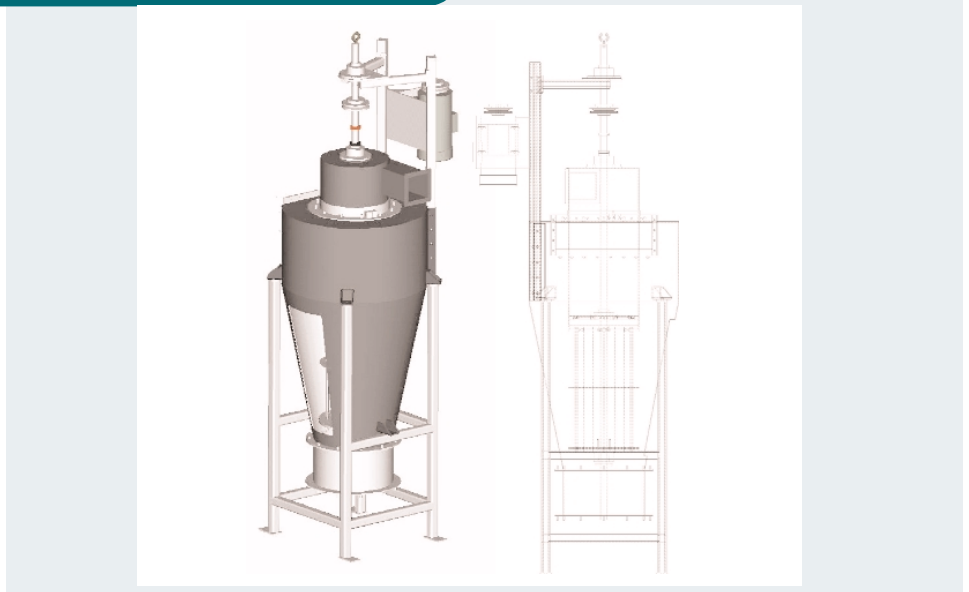
### A NEW METHOD TO CLASSIFY INDUSTRIAL POWDERS REDUCES ENERGY USE AND WASTE

Many industrial processes involve the separation of particles from an airstream. The mining industry, in particular, has indicated a need for improved separation methods and reduced waste. One challenge of particle separation is that soft, or unfired, ceramic particles cannot be separated using conventional classifiers because classifier vanes cause particle attrition. When classification is delayed until after calcining, energy is wasted in processing off-spec material that subsequently becomes waste.

For example, in kaolin processing, existing classification technologies such as conventional cyclone separators, sieves, and vane classifiers are inefficient, and energy intensive and lose product through attrition. Most conventional air classifiers use rotating vanes, resulting in particle attrition and concomitant vane erosion.

A new technology, the dynamic cyclone classifier, is designed for use on unfired particles at the front end of a process. The dynamic cyclone technology eliminates classifier vanes, allowing classification of soft particles without attrition. This innovation integrates two technologies, a patented boundary-layer exclusion filter and a cyclone separator, to separate particles from an airstream by controlling centrifugal airflows.

### DYNAMIC CYCLONE CLASSIFIER



The dynamic cyclone classifier, being developed by InnovaTech, Inc., incorporates a boundary-layer separator within a cyclone housing that allows sharp classification of soft ceramic particles.



## Project Description

**Goal:** Confirm prior bench-scale dynamic cyclone classification performance by successfully constructing and testing a full-sized prototype.

The dynamic cyclone classifier integrates two technologies that separate particles from an airstream by controlling centrifugal airflows: a patented boundary-layer exclusion filter and a cyclone separator. An inlet flow-positioning mechanism provides separation and classification control. The boundary-layer exclusion filter consists of a stack of annular disks. Oversized particles are ejected from the perimeter of the disks by centrifugal force, while undersized particles pass through the boundary layers of air. The dynamic cyclone creates a forced vortex flow between rotating disks. In this technology, the particles are separated and transported by airflows, which minimizes particle impact and attrition as well as component wear.

InnovaTech, Inc., is developing this new technology with the help of a grant funded by the Inventions and Innovation Program in the U.S. Department of Energy's Office of Industrial Technologies.

## Progress and Milestones

- Design, procure, and assemble necessary components for a full-scale prototype classifier.
- Test, validate, and quantify prototype performance for efficiency and wear.
- Refine market assessment and formalize business plan.
- Commercialize the technology through licensing to established manufacturers of industrial process equipment; relationship with a well-established partner has been established.

## Economics and Commercial Potential

The dynamic cyclone classifier offers substantial potential for indirect energy savings by reducing the amount of off-spec product processed to achieve the same amount of product output. The energy savings are equivalent to the amount of heat required to calcinate off-spec products that could not be classified before being fired using conventional classifiers.

Particle classifiers have two market segments: new equipment sales and replacement of installed classifiers. The new dynamic cyclone classifier will be target marketed for replacing inefficient or ineffective particle classifiers within the installed base. This technology is expected to capture 2%, or 1000 units, of the installed base segment within two years of market entry. In addition, InnovaTech, Inc., expects to capture a small percentage of the market for new classifier equipment. This technology could save 185 billion Btu of natural gas per installed unit each year. First sales for the technology are expected by 2003. Based on 14% market penetration by 2010, annual savings could be 13 trillion Btu with 7000 units operating. Market penetration of 30% by 2020 could save 27 trillion Btu from 15,000 operating units.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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## INDUSTRY OF THE FUTURE—MINING

*In mid-1998, the National Mining Association reached an agreement with the U.S. Department of Energy's Industries of the Future Program to join in creating research and development partnerships to develop and deploy new technologies that will improve environmental performance and enable the industry to meet increased global competition. The mining industry supplies the minerals and coal essential to the infrastructure of virtually the entire U.S. economy: glass, ceramics, metals, and cement for buildings, bridges, roads, and equipment, and coal or uranium to generate more than 70% of the nation's electricity.*

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