

INDUSTRIAL TECHNOLOGIES PROGRAM

Development of High-Density Infrared Based Surface Enhancement Technology for Mineral Processing Equipment

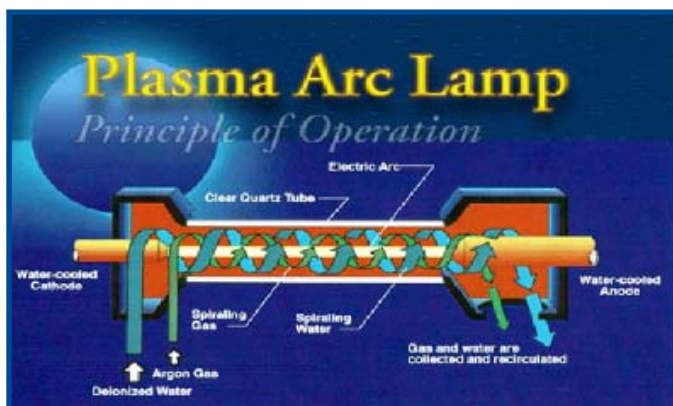
New Surface Enhancement Technology Will Help Diminish Wear and Corrosion of Mineral Processing Equipment and Save Energy

Major efforts have been made to reduce the wear of cyclones, pumps, heavy medium vessel plates, and other components used in mineral processing over the past two decades. Significant progress has been achieved through the use of ceramic linings, which have considerably increased the lifetime of equipment such as hydrocyclones. However, little has been done to reduce the wear of screens, chains for conveyors, pipings, and other devices where ceramic lining is impractical. For instance, the screen aperture increases as material wears, resulting in inconsistent aperture sizes that decrease screening efficiency by creating non-ideal feed to downstream operations. Frequent replacement of screens, conveyors, and pipes increase equipment downtime and maintenance cost, reducing process efficiency.

Researchers at the University of Kentucky and Oak Ridge National Laboratory are developing

advanced High-Density Infrared (HDI) and laser-based surface enhancement technologies for decreasing the wear and corrosion rate of mineral processing equipment by an order of magnitude. The process is easily adaptable to automation and less expensive than current methods.

Enhanced component surfaces will be achieved through three concepts. First, through controlled thermal treatment of surfaces to convert them to higher hardness for a known level of depth, without affecting the core properties. Second, through controlled thermal treatment of surfaces to enrich them with certain elements for a known level of depth, without affecting the core properties. Finally, through controlled thermal treatment of surfaces to fuse and diffusion-bond externally applied coatings of select hard materials. The component surfaces treated by these concepts will be characterized by the following methods: metallography, micro-hardness profiles, and microprobe analysis. The enhanced surfaces will also be characterized for their bend resistance, debonding in case of coatings, and wear resistance under simulated mineral processing conditions.



HDI Surface Enhancement Technology



Benefits for Our Industry and Our Nation

- *Decrease plant maintenance time by 20%.*
- *Increase energy efficiency by reducing downtime and increasing productivity.*
- *Extend the lifetime of screens and piping 10-fold.*
- *Improve worker health and safety by less frequent exposure to noise and risks involved in maintenance and replacement activities.*

Applications in Our Nation's Industry

This technology has many potential applications in the mineral processing and coal preparation industries including, but not limited to, crushers, grinding mills, pumps, pipes, conveyors, and compressors.

Project Description

The objective of this project is to develop a cost-effective advanced surface enhancement technology for decreasing, by an order of magnitude, the wear and corrosion of equipment that is used widely in mineral processing and coal preparation plants.

The project addresses compelling issues facing the mining industry. This technology can be made readily available for the entire mining industry. In order to rapidly commercialize the technology, the proposed program consists of both laboratory development and testing, and on-site demonstration. To facilitate the development and commercialization process, the University of Kentucky Research Foundation has established partnerships with coal, mineral, and aggregate mining companies, as well as screen and chain manufacturers. After successful technical and feasible evaluation, the screen and chain manufacturers will eventually license and commercialize the technology, first at the participating mining companies, and then to the entire mining industry.

Milestones

- Sample acquisition and characterization. (2004)
- Assess three different surface enhancement methods. (2004)
- Optimize process parameters. (2005)
- Test wear resistance of coated screens, chain components, and pipings in the laboratory. (2005)
- Demonstrate surface enhanced screens, chain components, and pipings on-site at processing plants. (2006)
- Economical and technical analysis of the HDI process for screens, chain components, and pipings. (2007)

Commercialization

The proposed program addresses compelling issues facing the mining industry. The advanced surface enhancement technology to be developed will considerably reduce the maintenance cost and increase the process efficiency of minerals and coal processing plants. It can be made readily available for the entire mining industry. In order to rapidly commercialize the technology, the proposed program consists of both laboratory development and testing, and on-site demonstration.

The University of Kentucky partnering strategy is with coal, mineral, aggregate mining companies, a screen manufacturer, and a chain manufacturer is designed to facilitate the development and commercialization process. If the technology is evaluated to be technically effective and economically feasible, the screen manufacturer and chain manufacturer will license and commercialize the technology first at the participating mining companies and then to the entire mining industry.



ORNL HDI Facility

Project Partners

The University of Kentucky Research Foundation
Lexington, KY
Oak Ridge National Laboratory
Oak Ridge, TN
Carbontronics Fuel Management, LLC.
Lexington, KY
CONSOL Energy
Oakwood, VA
James River Coal Service Company
London, KY
Florida Rock Industries, Inc.
Tyrone, GA
AMVEST Mineral Services, Inc.
Charleston, WV
Kurtz Bros., Inc.
Groveport, OH
Phelps Dodge Mining Co.
Phoenix, AZ
Innovative Screen Technology
Chapmanville, WV
Jeffrey Chain Corporation
Morristown, TN
Energy Industries of Ohio
Independence, OH
Kentucky Coal Association
Lexington, KY
Ohio Coal Development Office
Columbus, OH
Massey Energy Co.
Charleston, 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.



U.S. Department of Energy

**Energy Efficiency
and Renewable Energy**

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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