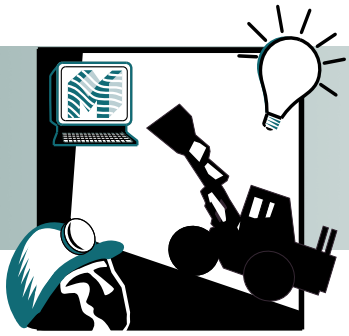
MINING

Project Fact Sheet



Fibrous Monolithic Composites as Wear-Resistant Components for Mining

Benefits

- Increases cost/performance ratio of wear materials
- Increases employee output
- Reduces energy consumption by decreasing pollution
- Reduces health-related and clean-up costs

Application

This project is developing wear-resistant components for drilling, earth-moving and crushing equipment. The components will be made of fibrous monolith composite materials.

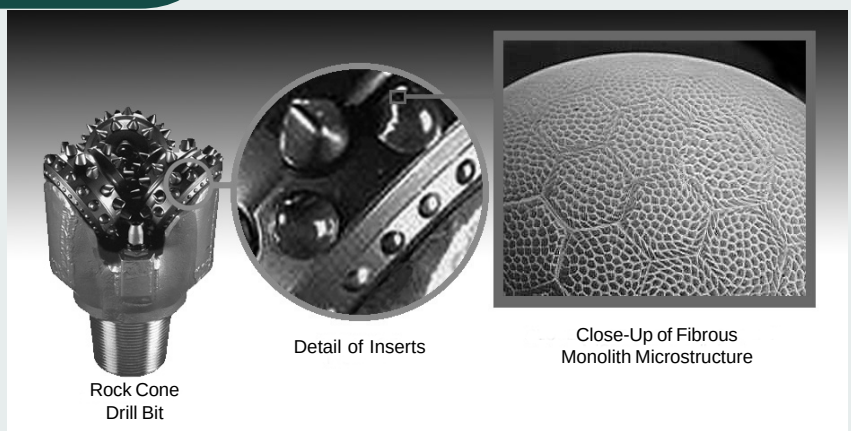
Wear-resistant fibrous monolith composite components improve cost/performance ratio of sophisticated wear materials

Fibrous monolith (FM) composites are an exciting new class of structural ceramics that exhibit mechanical properties similar to Continuous Fiber Ceramic Composites (CFCCs), including very high fracture energies, damage tolerance, and graceful failure. FMs are produced using a simple process in which sets of inexpensive, thermodynamically compatible ceramic and/or metal powders are blended with thermoplastic polymer binders and then co-extruded to form a 'green' fiber. The green composite fiber can then be wound or braided into the shape of the desired component using any conventional composite architecture. The fabricated green components are then pyrolyzed to remove the polymer binder and sintered or hot-pressed to obtain the final FM product.

Fibrous monolith composites will be used to develop novel wear-resistant components for drilling, earth-moving and crushing equipment. The FM composite materials will reduce the wear rate and eliminate the catastrophic failure of these wear components, resulting in an improved cost/performance ratio compared to the steel, iron, and carbide components currently used by the mining industry.

Mining is a capital-intensive activity, where component and material selection is driven by the cost/performance ratio. The primary reason mining companies use inexpensive wear materials is that the more sophisticated wear materials do not offer significantly higher performance to justify their higher initial cost. This project will improve the cost/performance ratio of wear components by simultaneously increasing the hardness and the toughness of the materials through the use of cost-effective ceramic- and metal-based FM composites.

Roller Cone Drill Bit



Fibrous monolith microstructure of a roller cone drill bit.

Project Description

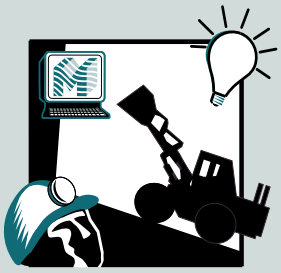
Objective: To offer advanced wear resistant materials, in the form of fibrous monolith composites, which will overcome the cost/performance barrier traditionally associated with advanced materials and significantly increase the wear life of targeted components.

The project is a collaborative effort of component manufacturers, end users, a National Laboratory, and universities. The project will target three particular wear components that offer a broad cross-section of wear conditions and environments encountered in the mining industry. These components are: 1) drill bit inserts used for drilling blast holes 2) dozer teeth used in a variety of earth-moving equipment, and 3) hydrocyclone apex cones, used in cyclone separators for sizing of crushed ore. As the project progresses these target items will be evaluated for appropriateness to the goals of the program. The project team will design fibrous monolith structures or coatings into existing components. The project team members will fabricate, inspect, and test the components in real operating environments. Team members will also develop process workbooks for fabricating fibrous monoliths, non-destructive evaluation of components, and modeling of composite/component behavior under typical stress and wear conditions.

Progress and Milestones

Activities to be completed in this project include:

- Develop new fibrous monolith compositions for wear-resistant mining applications.
- Demonstrate improved testing and characterization techniques for fibrous monolith components.
- Demonstrate improved wear performance, increased lifetime, or lowered total cost of ownership through implementation of fibrous monolith components.



PROJECT PARTNERS

Advanced Ceramics Research, Inc.
Tucson, AZ

Argonne National Laboratory
Argonne, IL

Inco Ltd.
Copper Cliff, ON

Krebs Engineers
Tucson, AZ

Phelps Dodge Bagdad Corp.
Bagdad, AZ

Phelps Dodge Sierrita Corp.
Green Valley, AZ

University of Arizona
Tucson, AZ

University of California-Santa Barbara
Santa Barbara, CA

Kyocera Corporation
Sendai, Japan

FOR MORE INFORMATION, PLEASE CONTACT:

Office of Industrial Technologies
Clearinghouse
Phone: (800) 862-2086
Fax: (360) 586-8303
clearinghouse@ee.doe.gov

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www.oit.doe.gov/mining

Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

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