



POWER GENERATION & UTILITY FUELS

PROJECT FACTS

UNIVERSITY OF KENTUCKY
CENTER FOR APPLIED ENERGY RESEARCH

Development of an Advanced Surface Enhancement Technology for Decreasing Equipment Wear and Corrosion

PARTICIPANTS

UK Dept. of Mining Engr.
UK Center for Applied
Energy Research
Oak Ridge National Lab
Amvest Minerals
Carbontronics Fuels
Consol Energy, Inc.
Florida Rock Industries
James River Coal
Kurtz Bros. Inc.
Pheps Dodge Mining
Innovative Screen
Jefferey Chain
Updated 2-10-04

SPONSORS

US Department of
Energy

PROJECT VALUE

DOE Cost: \$1,250,670
Industry Cost Share:
\$1,001,669
UK: \$258,990

CONTACT

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This project involves the development of an advanced surface enhancement technology for decreasing the wear and corrosion rate of mineral processing equipment by **an order of magnitude**. The proposed process is expected to be easily adaptable to automation and less expensive than current methods. Such performance improvement should result in energy savings of 2.45×10^{14} Btu/year. Significant efforts have been directed toward reducing wear of cyclones, pumps, heavy medium vessels, etc. used in mineral processing during the last two decades. Major progress has been achieved through the use of ceramic linings that have considerably increased the lifetime of hydrocyclones. However, little has been done to reduce the wear of screens, chains for conveyors, and piping where ceramic lining is impractical. The development of advanced surface enhancement technology is of great interest for the mineral processing and coal preparation industry.

This project deals with the use of a High-Density Infrared (HDI) based method for producing enhanced surfaces. The method will be used to achieve enhanced component surfaces through the following concepts:

- Controlled thermal treatment of surfaces to convert them to higher hardness for a known level of depth, without affecting the core properties. The computerized time temperature transformation (TTT) models that are only dependent on steel chemistry will be used to select the surface temperature for a desired surface microstructure and hardness.
- Controlled thermal treatment of surfaces to enrich them with certain elements for a known level of depth, without affecting the core properties. The elements will be selected to produce a higher wear resistance and/or corrosion resistance. Some of the elements to be considered will include: Si, C, B, Al, Ni, Cr, etc. The element selection will be based on the ThemocalcTM analysis, TTT models, and corrosion data.
- Controlled thermal treatment of surfaces to fuse and diffuse bonds externally to applied coatings of hard materials. The coating materials will include WC, Cr₂C₃ and others. The carbide coatings will include a variety of matrix materials including Ni, Ni-Cr, and CO. The coatings will be applied by methods such as plasma spraying, tape casting, and spraying of slurries. A range of coating thicknesses (10 μm to 2 mm) will be feasible based on this method of application.

