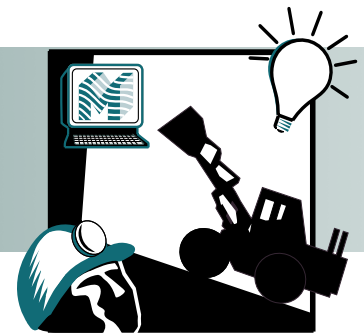


# MINING

## Project Fact Sheet



## MINE COMPATIBLE LASER ANALYSIS INSTRUMENT FOR ORE GRADING

### BENEFITS

- Estimated energy savings of 1.3 trillion Btu per year by 2020
- Decreases wear on equipment by avoiding low quality ore
- Increases production time on high quality ore
- Decreases processing and transportation costs

### APPLICATION

The laser analysis instrument being developed applies to all surface mining applications. This technology can also be used in various other industries. Specific examples include: the process control of steel production, monitoring off-gas emissions, and thermal waste treatment.

### IN-SITU ANALYSIS TOOL REDUCES AMOUNT OF ORE TO BE PROCESSED BY AVOIDING LOW QUALITY ORE

Laser Induced Breakdown Spectroscopy (LIBS) is an important new analysis technology that permits fast, direct, inorganic analysis without sample preparation. Presently, most surface mining operations rely on laboratory-based analysis to monitor the extraction process. This method includes numerous steps that increase the chance of contamination and error, and increases the time for analysis. X-ray fluorescence is the commercially used method for in-situ analysis of ore, but its instruments contain radioactive sources that must be regulated, and they lack the sensitivity needed to identify a variety of elements in different sample matrices.

LIBS technology will improve the efficiency of mineral ore extraction through real-time measurements of ore quality. The cost savings are realized by reducing the out-of-seam dilution of the ore being recovered, transported, and processed, without increasing the cost of sampling and analysis. Also, because the proposed instrument is capable of measuring virtually all inorganic elements, it is directly applicable to all surface mining applications. Use of this rugged technology will improve the energy efficiency of mining and processing of ore by limiting the need to move excess top soil or overburden.

### LIBS INSTRUMENT



LIBS instrument (left) performing analysis at mine site (right).



## Project Description

**Goal:** To better understand the composition of ore at the rockface and during transport to ore processing facilities using new laser analysis technology.

Laser Induced Breakdown Spectroscopy (LIBS) is an ideal analytical method for real-time quantitative analysis of inorganic elements in solids and liquids and requires no sample preparation. In laser spectroscopy, a laser pulse is focused to a spot just above the sample surface. This intense radiation initiates a series of processes including the formation of a hot plasma cavity above the sample that ablates a small amount of material from the sample surface into the hot plasma cavity. Ablated atoms that enter the plasma region are dissociated and ionized. Time-resolved optical emission spectra are collected from the plasma fireball and analyzed to determine the wavelength and intensities of the line radiation from constituent elements of the sample material. The major spectral lines in this data are compared with a stored database to determine the identity and determine the concentration of the constituent elements. Using this technique, sensitivities of parts-per-million have been achieved for a variety of elements in different sample matrices.

## Progress and Milestones

This project includes the following activities:

- Compile detailed requirements for the LIBS field instrument
- Design and test a pre-production prototype instrument
- Manufacture an instrument for on-site testing
- Perform an extended on-site demonstration



### PROJECT PARTNERS

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