



INDUSTRIAL TECHNOLOGIES PROGRAM

Measurement and Control of Glass Feedstocks

Technology to Measure Chemical Makeup of Glass Feedstocks Can Enhance Product Quality and Increase Productivity

Laser-induced breakdown spectroscopy (LIBS) promises a new way for glass manufacturers to significantly increase productivity. By measuring the chemical makeup in raw materials and recycled glass cullet, LIBS can quickly detect contaminants and batch nonuniformity. By preventing the production of defective products, glass manufacturers can reduce production costs, energy usage, and improve glass quality.

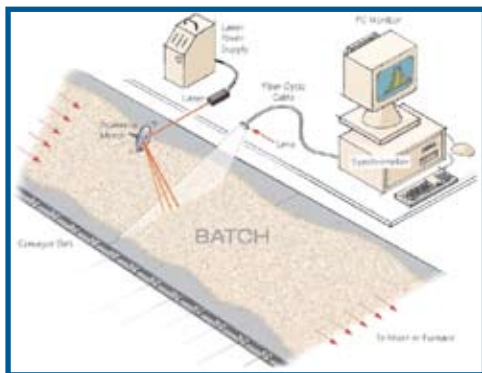
LIBS provides high measurement speeds for the high throughput of small particles. The technology is capable of measuring both granular materials in the batch as well as larger materials such as crushed cullet and the contaminants that are often found in the cullet. These capabilities ensure that poor quality or non-uniform raw materials and batch mixtures do not enter the furnace. LIBS technology will also aid in finding optimal furnace parameters for particular mixtures. As a result of repeatable batch formulations entering the

furnace, the technology will enable more accurate measurements of the effects of changing different furnace parameters on glass quality.

Project Description

Goal: Develop a laser-induced breakdown spectroscopy (LIBS) instrument to measure in real time and in-situ the chemical makeup of industrial glass processes and feedstocks.

The LIBS device can immediately determine if a process or feedstock is off-spec and can be used in a feedback control loop to correct problems. Project partners have experimentally verified that LIBS can measure the composition of glass feedstock materials. A commercial instrument has been installed in a fiber glass plant for measuring the composition of glass batch ingredients. The user friendly instrument was designed for use by non-specialist plant employees.



Schematic of Energy Research Company's LIBS Batch Analyzer



Benefits for Our Industries and Our Nation

- Enhanced product quality
- Increased productivity
- Decreased energy consumption
- Reduced emissions

Applications in Our Nation's Industries

The LIBS device can be used to determine the chemical makeup of glass feedstock before it enters the melting furnace. The technology can improve product quality by determining batch integrity, sorting cullet by color, and detecting contaminants. The technology is expected to dramatically improve competitiveness in all sectors of the U.S. glass industry.

For More Information

For technical information regarding the LIBS system, as well as pricing and purchasing information, please contact Robert De Saro of the Energy Research Company at (718) 608-8788 or rdesaro@er-co.com.

Progress and Milestones

- The project was awarded in late 2000.
- During the first year of the project, researchers demonstrated the following capabilities:
 - Identified LIBS signals for different batch minerals
 - Distinguished among different cullet colors at high speeds
 - Identified cullet contaminants at high speeds
- During the second and third year of the project, researchers:
 - Developed LIBS software for quantitative measurements of oxides in batch materials



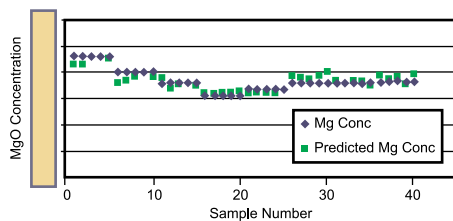
Photographs of Off-Line LIBS Batch Analyzer Installed at a PPG Fiber Glass Plant

- Built an off-line LIBS instrument for measuring the composition of batch ingredients
- Installed a user friendly LIBS batch analyzer in PPG's Chester, SC fiber glass plant
- The application of laser induced breakdown spectroscopy to inspect glass processes and feedstocks is expected to yield the following benefits:
 - Energy savings of 260 to 520 billion Btu per year – 20 percent reduction in product defects, saving the glass industry \$220 to \$440 million

Commercialization

Energy Research Company is aggressively pursuing commercialization of this technology. Marketing consultants have been hired to study the glass market for the most attractive configuration of the analyzer and to develop a business plan for selling the analyzers to the glass industry.

Element	Ulexite Component	Avg. Error
Boron	Major	0.35%
Calcium	Major	0.50%
Sodium	Major	1.83%
Silicon	Minor	4.03%
Magnesium	Minor	2.25%



Results from In-Plant LIBS Batch Analyzer Operation

Project Partners

Energy Research Company
Staten Island, NY

PPG Industries, Inc.
Harmarville, PA

Fenton Art Glass Company
Williamstown, WV

Oak Ridge National Laboratory
Oak Ridge, TN

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.

For more information contact:
EERE Information Center
1-877-EERE-INF (1-877-337-3463)
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