What is LIBS?

Laser-Induced Breakdown Spectroscopy (LIBS) is a spectroscopic technique using a laser-generated plasma to ablate and excite a sample, usually in solid form. Emission generated from the plasma is used to identify material constituents and can be used to identify, sort, and classify materials.

What can LIBS be used for?

LIBS can be used both in-process and in the laboratory for material identification. A very versatile method, it boasts the following advantages:

- Rapid analysis with no or minimum sample preparation
- Sensitive to a wide range of elements
- Simultaneous reporting of elements
- Matrix compatibility with virtually every solid sample

Laser-Induced Breakdown Spectroscopy utilizes a focused pulse from a high-powered laser to create a plasma. Some of the energy in the plasma is used to ablate sample material, and the plasma rapidly expands to form a gas plasma which is used to analyze the ablated particles.

Basics of LIBS

In LIBS, a pulsed laser with high peak power irradiates a sample. The beam is focused into a small analysis spot (typically 10-400 microns in diameter). In that spot, material from the sample is ablated, forming a cloud of nanoparticles above a small crater in the sample. Because the peak energy of the laser beam is quite high, absorption and multiphoton ionization results in increasing opacity in the gas and aerosol cloud above the sample, even during the short laser pulse. As laser energy is increasingly absorbed in that cloud, a plasma forms. The plasma melts the nanoparticles and excites atomic emission. The emission is dispersed onto a detector and we interpret the spectrum, which can simultaneously tell us about the presence of multiple elements. Software algorithms turn the spectra into qualitative results (e.g. positive material identification, PMI) and quantitative results (e.g. the concentration of a particular element in the sample.)

Detection limits and quantification

Detection limits for LIBS depend strongly upon the type of sample being measured, the specific element in question, and the laser / detector combination in the instrument. Detection limits can range from sub-ppm to 1 percent, given these factors, but for most elements in common applications detection limits are between 10 and 100 ppm. Relative standard deviation of measurements are easily 3-5% and are often better than 2% for homogeneous materials.

The ChemReveal® is designed as a flexible laboratory tool for analysis of a range of solid samples. From the integrated video and the programmable methods to the quantification software, the main features are intended to contribute to repeatability and simplicity.