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# Illuminate the solutions to your material challenges with the power of lasers

Elemental mapping by laser induced breakdown spectroscopy (LIBS) at Eurofins EAG Materials Science

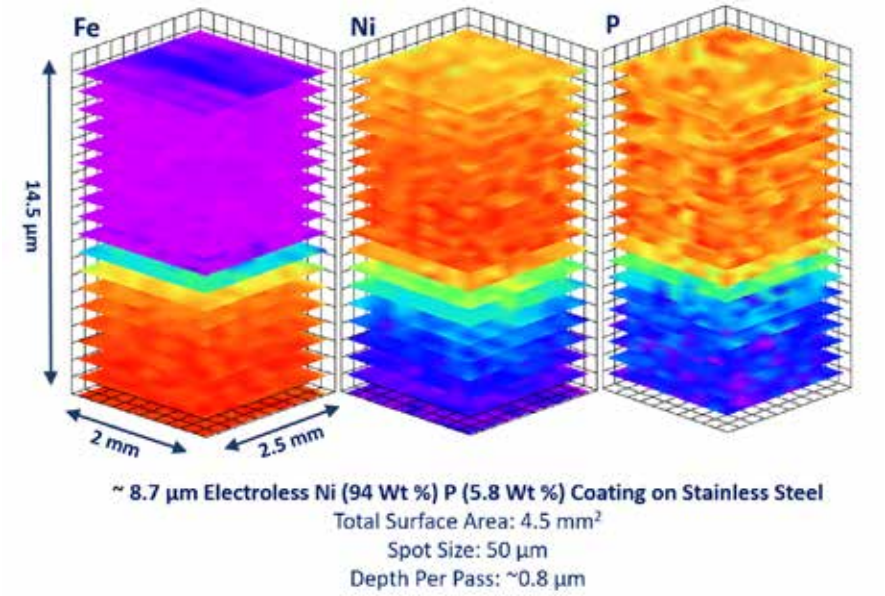



Figure 1. Example of 3D LIBS Mapping

Eurofins EAG Materials Science is proud to introduce state-of-the-art Laser Induced Breakdown Spectroscopy (LIBS) technology to our expanding analytical tool box, to better help solve your material and commercial challenges.

## What is Laser Induced Breakdown Spectroscopy?

LIBS is a powerful and versatile chemical analysis technique that combines automated pulsed laser micro-sampling

with optical emission spectrometry to characterize relative element abundances, and element distribution in solid samples. It excels at rapid 2D and 3D micro-scale elemental distribution mapping of any naturally occurring element down to parts-per-million levels.

Samples require no pre-preparation prior to analysis, and data collection is indirect, making LIBS particularly suitable for atmosphere-sensitive materials.

## What is LIBS used for?

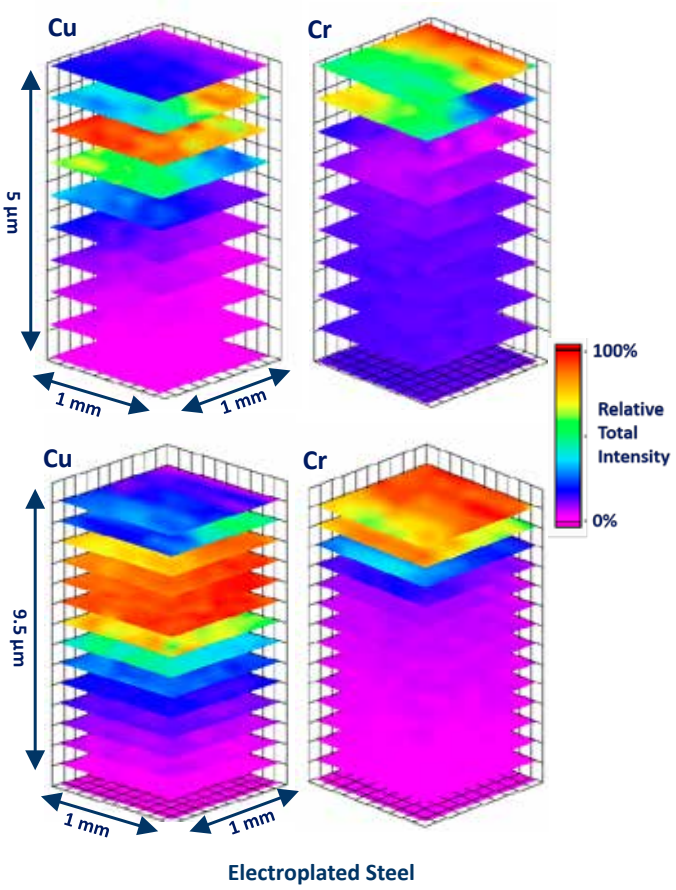
- Rapid composition surveys of all elements present in any solid material
- Micron-scale 2D & 3D trace element mapping
- Sub-micron depth profiling

## Did you know?

LIBS is so versatile and reliable it was included as part of the ChemCam assembly on NASA's rover Curiosity, and has been used extensively to study the geochemistry of Martian bedrock and soils!

## How Does LIBS Work?

LIBS uses a high energy pulsed laser to remove material from a sample's surface. The sample is placed on a motorized stage that moves in any pre-selected x, y or z direction, allowing for the fixed laser to scan over its surface. Each laser pulse removes nanograms to picograms of material, and can be used to analyze a single region between 20 and 200 µm in size, or a larger area using line patterns. A fixed spot analysis also allows for depth profiling.




**Top:** Cr (upper 0.8 µm) and Cu (1.7 µm) on Steel Substrate, 0.5 per depth pass

**Bottom:** Cr (upper 2 µm) and Cu (lower 4.5 µm) on Steel Substrate, 0.7 µm per depth pass

Figure 2: Example of 3D LIBS mapping stack with detailed 2D layers

The laser causes the formation of a micro-plasma that atomizes and ionizes the sample material, which rapidly undergoes expansion and cooling. During this time, the elements present in the plasma produce characteristic light emission wavelengths, in the near infrared to near ultraviolet range (180 to 1100 nm). A spectrometer located above the sample stage allows for simultaneous acquisition of the entire wavelength spectra produced by all present elements.

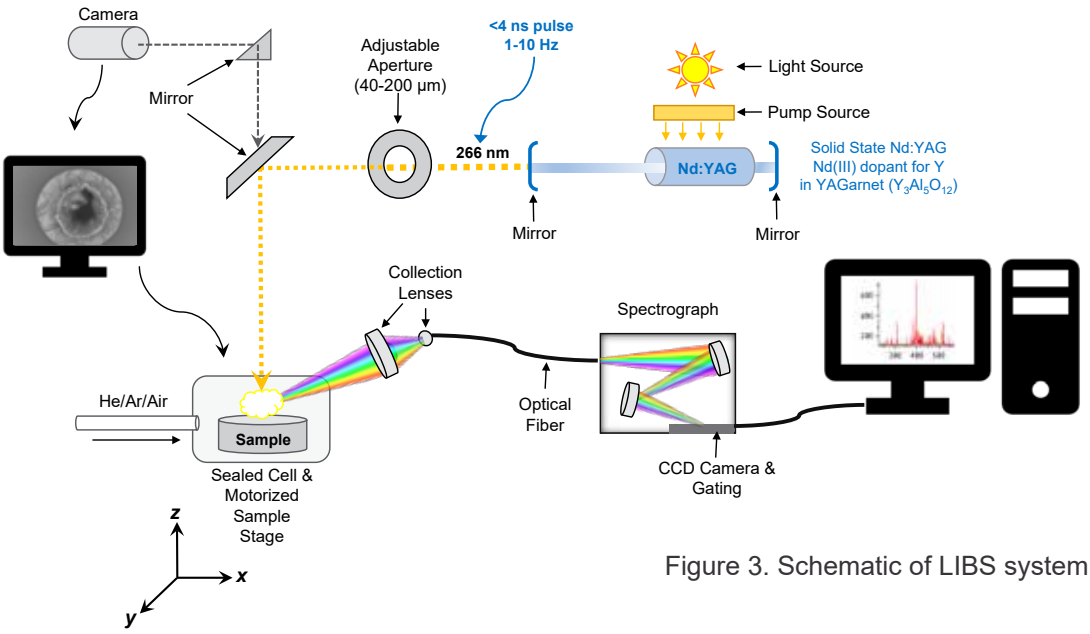



Figure 3. Schematic of LIBS system

## Examples of Suitable Materials/Applications

- Glass, Optical Displays
- Mining Products – provenance, tracing
- Manufactured Minerals and Abrasives
- Ceramics
- Cements, Sediments
- Solders (e.g. component micro-analysis)
- Sample/Near Surface (> ~1-2 µm)
- Metal Alloys
- Heavy Metal QC/Contamination (e.g. soils, pharmaceuticals, medical)
- High Purity Materials
- Impurities in Electronic Components
- Dental Ceramics and Porcelains
- Forensic Materials (e.g. hair, bone, ink)
- Nuclear Applications (e.g. Ga in Nickel)
- Thick Films and Substrates
- Rare Earth Dopants

# LIBS Services at Eurofins EAG

- 2D Trace/major elemental mapping
- 3D Trace/major elemental depth profiling/mapping
- 2D/3D Mapping & Advanced Statistical Data Processing (PCA)

## Our Technical Capabilities

- Laser Unit: Applied Spectra J200, 266 nm, Nd-doped YAG, ECCD detector
- Depth Profiling Resolution: >0.1 µm
- Spot Sizes: 40 – 200 µm
- Analysis Patterns: Spots, lines, rasters
- Cell Dimensions: 5 cm x 5 cm x 2 cm
- Sensitivity: 2 to 5 parts per million (ppmw)

Would you like more information about our LIBS services?

Call an expert at +1 (877) 709-3393 or go to www.eag.com/contact/