

High-resolution chemical mapping of geological samples utilizing the LIBS

Laser-Induced Breakdown Spectroscopy (LIBS) is a technique of atomic emission spectroscopy that has high application potential in the field of spatially resolved elemental analysis.

The advantages of LIBS are high rate and real time determination of broad range of elements (including light elements) with micrometric spatial resolution. Analysis of surfaces can be processed into the form of chemical maps.

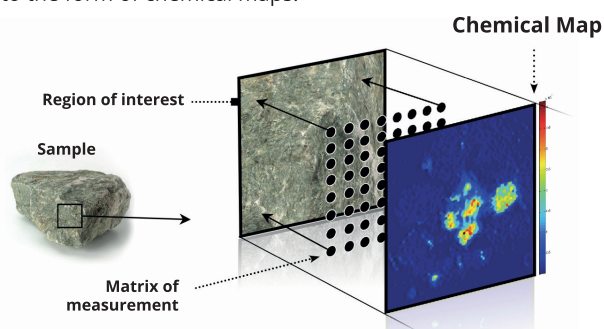


Fig. 1: Chemical mapping.

Chemical maps (or chemical images) provide the information about the surface distribution of the selected chemical elements in the analyzed area in a clear visual form (Fig. 1).

In this case, a sample under study was chalcopyrite rock fixed in epoxy resin. The sample was cut and the surface was polished prior to LIBS analysis (Fig. 2). The element of interest was Pb, Ni and Cu.

On the sample surface, an area of 25 × 25 mm² was analyzed with the resolution of 100 microns. This required the processing of 62 500 measurements in the chemical map of 250 × 250 points. Intensities of the Cu I 324.75 nm, Ni I 352.45 nm and Pb I 280.2 nm distinguished by the color scale are visualised in the chemical maps in Fig. 3.

The sample was analyzed using the Sci-Trace system in double-pulse (DP) LIBS configuration to maintain low crater diameter (50 μm) and high spatial resolution at the same time.

Analysis configuration: Double Pulse LIBS, 532 nm (30 mJ) and 1064 nm (80 mJ), interpulse delay: 1.5 μs, gate delay: 1.5 μs, gate width: 20 μs, spatial resolution 100 μm.



Fig. 2: Chalcopyrite cut in epoxy resin.

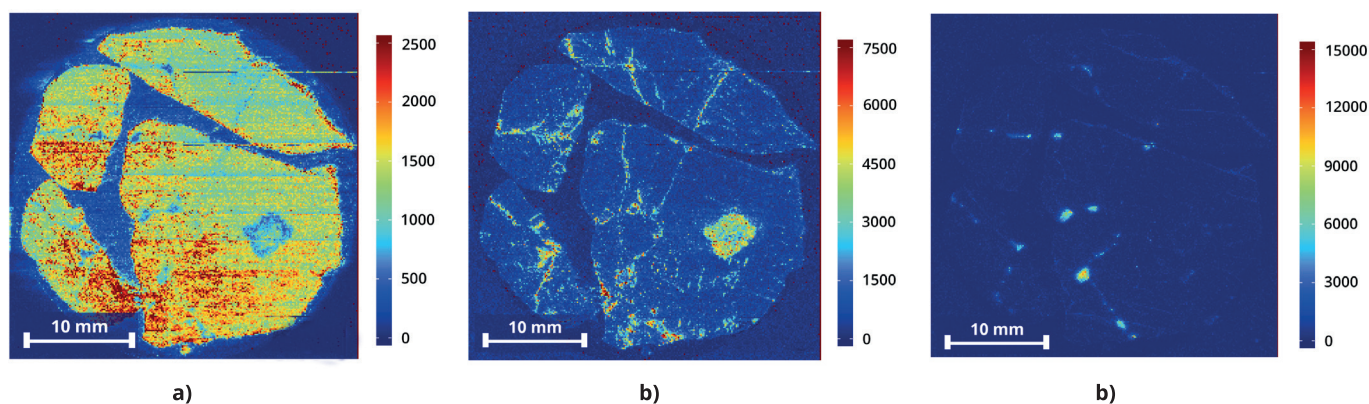
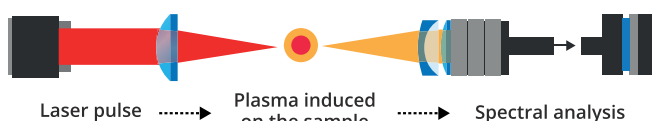


Fig. 3: Chemical map of a) Cu, b) Ni and c) Pb.

LIBS measurement with the Sci-Trace

Laser-Induced Breakdown Spectroscopy (LIBS) is a modern and flexible analytical technique. It is a combination of laser ablation and atomic emission spectroscopy. Pulsed laser rejects a small part (down to few nanograms) of analyzed material and creates a microplasma.



Spectral analysis of the laser-induced plasma radiation provides a qualitative and quantitative data about the chemical composition of the analysed sample.

It is possible to analyze solid, liquid or gaseous samples without any special sample preparation in a matter of seconds.

LIBS is sensitive to the majority of chemical elements, including light elements, with limits of detections as low as about 1-10² ppm.

Measurements from this application list were performed utilizing the **Sci-Trace** - configurable analytical instrument specialized on the LIBS technique.

Sci-Trace is designed by scientists for scientists and can be configured to meet the requirements not only of novice or experienced LIBS researchers but also of any analytical laboratory user. Sci-Trace is easily extendable with a number of specialized modules, therefore it is always ready for experimentator`s diverse ideas.

Sci-Trace includes advanced spectra processing software: the **AtomAnalyzer**.

