



LASER TECHNOLOGIES FOR THE PREVENTION OF INDUSTRIAL HAZARDS AND POLLUTION

Challenges & Markets

The **LIBS** (“**L**aser-**I**nduced **B**reakdown **S**pectroscopy”) enables **researchers to determine the chemical composition of a material in real time, on-site.**

This elementary characterization represents a genuine economic and ecological challenge in many industrial and environmental sectors whether it concerns **process control** and **raw materials, safety** and **security** or the **analysis of soils, effluents**, the search for **pollutants** or the sorting out of **valuable substances**

LIBS relies on the spectral analysis of the radiation emitted by a plasma produced by laser ablation in a very slight quantity of matter. This analysis enables us to determine the nature and concentration of the different chemical elements which make up the material.



LIBS for material monitoring

Value added offer

The DEN **offers industrialists the equipment, scientific competence and necessary techniques** in the development of any project necessitating the analysis of the composition of various materials or the search for traces in these materials. The personnel provides an **assistance** in the **analysis** and in the **interpretation of the results.**

An **expertise and consultancy activity** is offered to adapt the analysis to the specific need: from the design level to the actual implementation of a specific system if necessary right up to the optimization of the analysis protocols.

The goal of CEA/DEN is to meet the needs expressed by industrialists whether it's in terms of:

- **Use of the DEN's test means and competence** for specific analyses.
- **consultancy and expertise of:**
 - support in the development of specific systems
 - **license concession** and **industrial assistance**
 - **the creation of new collaborations or new industrial sectors**

Advantages of the technology

- Analysis *in real time, without contact and remote, of any types of material* (solid, liquid, gas, aerosol--whether they be conductors or insulators)
- Analysis without sampling or sample preparation
- Wide range of analysis, from the composition to trace detection
- Multiple configurations are possible , laptop or portable instrumentation, laboratory or field

Patents

CEA – Saclay possesses the protected know-how as well as 10 transferable patent families on this particular area of research:

- [FR2706614B1](#), [FR2712697B1](#) (expires in 2014)
- [FR2800466B1](#) (expires in 2019)
- [FR2844878B1](#) (expires in 2022)
- [FR2882593B1](#), [FR2892194B1](#) (both expire in 2025)
- [FR2906035B1](#) (expires in 2026)
- [FR2919720B1](#) (expires in 2027)
- [FR2964458B1](#) (expires in 2030)
- [FR2995403A1](#) (expires in 2032)

Technical offers

- Qualitative analysis/ Basic quantitative analysis,
- Analysis/ real time process control system,
- Analysis of raw materials, of compositions,...
- Detection of pollutants in the environment (soils, effluents,...)
- Development of tools and analysis methods

Expertise

- **Organization of the franco- LIBS and contribution to robot exploration of the Martian Curiosity soil**
- **Laser-Material Interaction**
- **Analytical chemistry**
- Surface characterization, Micro-analysis,
- Instrumentation

Equipment

CEA/DEN has important analytical instruments linked to plasma-emission spectrometry created through lasers (LIBS):

- **Customized LIBS systems**, equipped with the **LIBS** micro-probe to carry out micro-cartographies of chemical composition up to the μm ,
- **Tools developed and commercialized by the IVEA firm under CEA licensing: MobilIBS** (a compact, portable system that can perform analyses either in the lab or on-site), **EasyLIBS** (a portable, autonomous LIBS analysis system), **RemoteLIBS** (a remote measurement system, portable)
- **Tools of surface characterization and the consequent analytical infrastructure** for perfecting / monitoring/ validation

Our strong points :

20 years of expertise and know-how in Laser technologies for analysis

Key figures:

- Manpower:
10 research engineers / technicians and PHD students,
- 10 patent families protect these Laser technologies

They've entrusted us with their work:

AREVA, EDF, ANDRA, GDF Suez, IVEA, NASA