

Form 2

Technology Information	
Area	1 – Technologies for detection of minor leaks 1. 汚染水貯留 (3) 微小漏えいを検出できる技術
Title	CHARACTERIZATION OF MATERIALS BY REMOTE LIBS ANALYZER (AREVA 1-3-1) 遠隔レーザー誘起破壊分光法(LIBS)を用いた材料の特徴評価
Submitted by	AREVA / CEA

1. Overview of Technologies

Objective:

This technology allows detecting leaks using a portable Laser-Induced Breakdown Spectroscopy (LIBS) technology and Infra Red Spectroscopy technology. This device is able to scan the surface remotely, and also at contact. LIBS searches for the elements which may have leaked. A LIBS device may be mounted on an automated robot that goes around the tanks. Patrols may be equipped with a portable device.

Measurements can be gathered in geostatistic cartography tools, described in other AREVA/CEA technical sheets.



Functions

Realize non-destructive measures on samples (water, soil) for the detection of tracers of the radioactive contamination.

Two applications of the Laser-Induced Breakdown Spectroscopy (LIBS) technology are available:

A/ Recognition of materials and shades of materials under on-site conditions.

B/ Detection of hazardous elements on materials surfaces

Summary Descriptive

A/ Recognition of materials and shades of materials under on-site conditions

1. Identification of materials using their elemental composition that is measured by LIBS,
2. Degree of discrimination of materials (metals, shades of alloys, polymers, ...) can be adjusted using simple or advanced LIBS data treatment
3. Diagnostic device that can be manually-handled or automated on a robot for hostile environments as a support for operational decisions for dismantling

B/ Detection of hazardous elements on materials surfaces

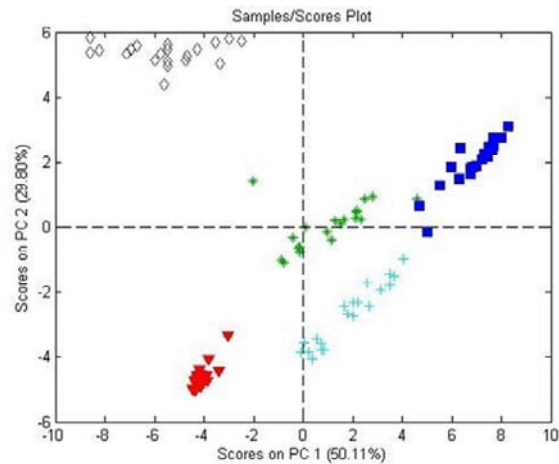
1. Detection of toxic elements on surface of materials by LIBS which is a control equipment for safety operation and identification of materials
2. Dedicated software for data analysis with defined threshold per toxic element

Features & Specifications

The LIBS technology is based on the use of a pulsed laser that is focused onto the sample surface, providing sufficient irradiance to generate ablation of the surface and create a plasma. The elemental composition of the plasma is therefore related to the composition of the sample surface, and specific emission rays can be recorded. Hence, the analysis of the emission spectra directly gives information on the elemental composition of the sample, which can be used for qualitative or quantitative analysis.

Among the variety of applications, two different types can be noticed:

- The elemental fingerprint can be used for identification or discrimination of materials or shades of materials. Depending on the degree of discrimination, several data treatment methods can be used.
- Chemical (radio)toxic can be detected on the surface of materials like waste packages, and eventually quantified.



Example of discrimination of steel samples using chemometrical data treatment

The LIBS technique is fully-optic, and gives the results within few seconds. Consequently, it is particularly suitable for remote analysis. Both laboratory and portable LIBS systems do exist and are already commercialized. Moreover, specific LIBS systems can be integrated on automated robot for routine quality control on a process flow, or for diagnostic of process units, particularly under hostile conditions.

Photograph of a portable LIBS analyzer for on-site analysis under hostile conditions

The equipment is composed of the following parts:

- A LIBS analyzer composed of a laser, a spectrometer, optics and electronics
- A microcomputer with a dedicated software for the control of the instrument and for the data treatment

Advantages of our Technology

- Rapid measurement (few seconds) adapted to real-time diagnostic
- Remote measurements
- Different sizes and utilizations: laboratory, portable, robot-embedded
- Multi-elemental analysis : possible accurate recognition of shades of materials, detection of several toxic elements at the same time

Owner

Patent by CEA-AREVA

Fabrication and commercialization by IVEA Solution

2. Notes**Technology readiness level**

LIBS systems are already commercial, including portable systems. For recognition and element detection applications, which both require specific data treatment developments.

Challenges

- Achieve sufficient sensitivity depending on the applications
- Development of specific data treatment software
- Resistance of the equipment for in situ application under hostile conditions

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