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Remote LIBS system for in situ material characterization in nuclear facilities under decommissioning

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The decommissioning and dismantling (D&D) of nuclear facilities requires a careful radiological and chemical inventory, especially in the preparation phase prior to the definite facility shutdown. Many analyses must be carried out on samples shipped to radiochemical laboratories, which often is a complicated, costly and time-consuming process. There is a demand for in situ and rapid analysis techniques, without sampling, particularly adapted to contaminated areas where the time of presence of operators is very restricted. Complementary to nuclear analysis technique, the LIBS (Laser Induced Breakdown Spectroscopy) technique offers the possibility of characterizing materials on site.

A LIBS device has been developed taking into consideration the limited accessibility to the contaminated areas in D&D facilities. It is composed of a portable probe connected both to the laser and to the spectrometer by two optical fibers (Figure 1). First tests of surface contamination detection were carried out in a former uranium manufacturing facility (CEA Cadarache, ATUE) during decommissioning of the building (Figure 2).

The LIBS system is now under qualification in our laboratory for material discrimination. By using the Principal Component Analysis (PCA) chemometric method, the discrimination of different metals (aluminum, steel, copper, zinc...) has been demonstrated. Other data treatments are under evaluation in view of the use of this system by non-expert end users.



Figure 1: Remote LIBS system



Figure 2: Tests of the LIBS system into ATUE building