LIBS probe for in-situ material characterization

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Keywords: LIBS, decommissioning, in-situ characterization, material, identification

The needs in terms of chemical characterizations for dismantling operations are first the inventory of materials either for appropriate and safe waste management or for refining neutron calculations and secondly to map the contamination. In both cases, a large number of measurements must be carried out. Given the difficulties of sampling management (storage, handling and transport) or overload of analytical laboratories, in-situ analysis methods without sampling, such as LIBS (Laser Induced Breakdown Spectroscopy), are to be preferred.

Moreover the limited access of nuclear facilities being decommissioned renders an adaptable remote LIBS analysis device very suitable for determining the chemical composition of materials.

The LIBS device that we have developed includes a portable probe connected both to the laser and to the spectrometer by two optical fibers (Figure 1). This instrument has been already used for some applications. For example, tests were carried out in the a uranium manufacturing facility (CEA Cadarache, ATUE) during decommissioning of the building to determine uranium contamination fixed on the surface of the walls (Figure 2). The LIBS system was also used to characterize on site the nature of alloys constituting various parts of UF_6 containers, providing an instant response to the operator.

It is planned, in interaction with CEA/DPAD, to realize in-situ steel grade determination of some parts located into the G1 reactor (CEA Marcoule). Thanks to its versatility other possibilities of uses could be envisaged with this device to match the needs of dismantling operators.

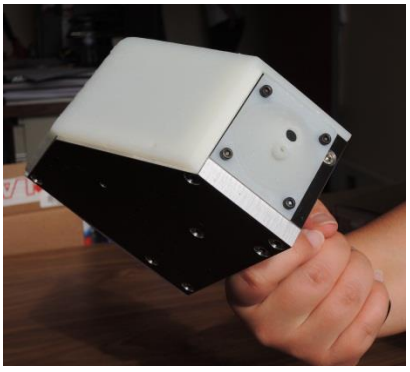

Figure 1: LIBS probe for remote analysis

Figure 2: Utilization of the LIBS probe into ATUE building