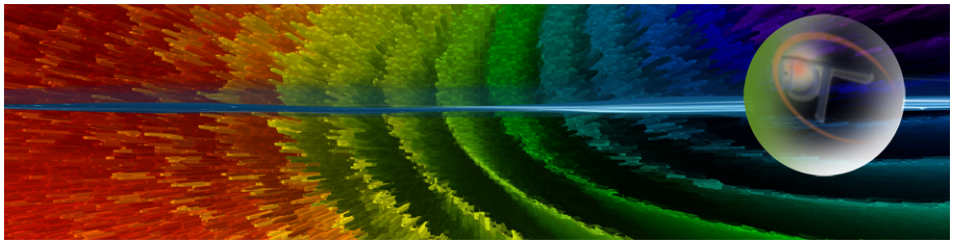

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LIBS application to deposited layers diagnostics in fusion machines

Laser Induced Breakdown Spectroscopy (LIBS) is nowadays a well established tool for qualitative, semiquantitative and quantitative analyses of surfaces, with micro-destructive characteristics and capabilities for stratigraphy. LIBS is an appealing technique compared with many other types of elemental analysis thanks to the set up versatility facilitating non-invasive and remote analyses, as well as suitability to diagnostics in harsh environments. LIBS capabilities have been tested for the determination of the atomic composition of multilayered samples simulating the tiles of plasma facing components in the next generation fusion machines such as ITER [1]. Experiments were carried on in a test chamber designed and realized in order to optimize the characteristics of a LIBS system working in vacuum and remotely [2], which simulated the in situ operation needed for monitoring the erosion and re-deposition phenomena occurring on the inner walls of a fusion device. The effects of time delay and laser fluence on LIBS sensitivity at reduced pressure were examined, looking for operational conditions suitable to analytical applications, both as surface characterization and stratigraphic profiles. The quantitative analysis of some atomic species in the superficial layer has been carried out using a Calibration Free (CF) approach in the time window where Local Thermal Equilibrium (LTE) was assumed for an LIBS analysis. Results obtained on ITER-like tiles where D atoms were implanted demonstrated a performance suitable to determine D concentration within the accuracy needed for the specific in situ application.
First experiments on FTU have demonstrated the remote application of the LIBS technique to detect major surface components also in the presence of intense magnetic fields.
Double pulse experiments, carried out in cooperation with the Institute of Plasma Physics and Laser Microfusion of Warsaw, allowed to increase the detection sensitivity in order to detect hydrogen isotopes at concentration of the order of 1%.

References

1] Courtois, X., Sortais, C., Melyukov, D., Gardarein, J.L., Semerok, A., Grisolia, C., 2011 “Development of laser lock-in thermography for plasma facing component surface characterisation” Fusion Engineering and Design. 86: 1714-1718.
2] S. Almaviva, L. Caneve, F. Colao, R. Fantoni, G. Maddaluno, 2012 “Remote-LIBS characterization of ITER-like plasma facing materials” J. Nuclear Materials, 421: 73-79.

Primary author: Dr FANTONI, Roberta (ENEA FSN-TECFIS, V. E Fermi 45 Frascati (I))

Co-authors: Dr COLAO, Francesco (ENEA FSN-TECFIS-DIM, V. E Fermi 45, Frascati (I); Dr MADDALUNO, Giorgio (Assoc. ENEA-EURATOM sulla Fusione, CR Frascati (I)); Dr CANEVE, Luisa (ENEA FSN-TECFIS-DIM, V. E Fermi 45, Frascati (I); Dr CHIRICO, Roberto (ENEA FSN-TECFIS-DIM, V. E Fermi 45, Frascati (I); Dr ALMAVIVA, Salvatore (ENEA FSN-TECFIS-DIM, V. E Fermi 45, Frascati (I))

Presenter: Dr FANTONI, Roberta (ENEA FSN-TECFIS, V. E Fermi 45 Frascati (I))