LIBS analysis of samples from the COMPASS vacuum chamber during liquid metal experiments

P. Veis\textsuperscript{a,}\textsuperscript{*}, A. Marin Roldan\textsuperscript{a}, V. Dwivedi\textsuperscript{a}, P. Barton\textsuperscript{b}, M. Jerab\textsuperscript{b} and R. Dejarnac\textsuperscript{b}

\textsuperscript{a} Department of Experimental Physics, FMPI, Comenius Univ., Mlynská dol. F2, Bratislava 842 48 Slovakia
\textsuperscript{b} Institute of Plasma Physics, Czech Academy of Sciences, Prague, Czech Republic

*pavel.veis@fmph.uniba.sk

Robust materials are required to withstand large particle and heat fluxes from the plasma inside a fusion reactor. One of the main issues in the next step fusion devices will be the erosion of the plasma-facing materials (PFMs) that could be up to centimeters. Erosion determines the lifetime of the PFMs and creates a source of impurities which cool and dilute the plasma. To overcome this problem, wall conditioning has been used since the early phases of the fusion research to provide the necessary conditions for plasma production and high plasma performance. Lithium conditioning is one of the methods employed, as it is able to reduce the oxygen and carbon impurity contamination by chemically binding these species to the wall. Liquid metals such as lithium or tin are being explored as potential PFMs in fusion reactors due to their several advantages such as self-repair or high power exhaust capability. However, as the rest of the new possible PFMs, it should be analyzed to see its limits and interaction with the vacuum vessel.

The main goal of this work is the characterization of the redistribution of liquid metal divertor elements over the whole COMPASS tokamak chamber by Laser-Induced Breakdown Spectroscopy (LIBS). As it has been proved in previous works, the Calibration Free LIBS method can be used for the quantification of Li and Sn containing samples [1]. The elemental depth profile analysis of a set of 14 inox-steel samples unmounted from the COMPASS tokamak vacuum vessel after liquid metal experiments [2,3] is presented. The location of the samples combined to the different thickness of the layers containing Li (Sn) provide information about the migration of the liquid metal material all over the tokamak. Two spectrometers were used for the LIBS analysis: a broadband echelle UV-NIR spectrometer (ME5000, iStar DH743, Andor) and a high-resolution spectrometer (THR 1500, Jobin Yvonne), coupled with an iCCD camera (iStar DH740, Andor). The measurements were performed under Ar atmosphere at different pressures. The electron density was determined from the Stark broadening of the H\textalpha~ spectral line at 656.3 nm.

Acknowledgement: This work has been carried out within the framework of the EUROfusion Consortium and has received funding from the Euratom research and training programme 2014–2018 and 2019–2020 under grant agreement No.633053. Work performed under WPDDT1-LMD. This work was also supported by the SRDA (APVV-16-0612) and by the VEGA (1/0903/17).

[3] J. Horacek et al. This conference