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P3.055 LIBS system on linear plasma device PSI-2 for in situ diagnostics of plasma-facing materials

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One of the keen interests of plasma-facing material diagnostics is the in situ measurement of fuel content on the material surface and monitoring the outgassing process in the early stage after plasma exposure. The W samples are exposed to D plasma (with a typical fluence of 5×10^{25} D/m²) on the linear device PSI-2. Laser induced breakdown spectroscopy (LIBS) is employed as the detecting technique thanks to its ability of in situ measurement [1]. In our previous work [2], the measurement starts at 40 minutes after plasma exposure due to the optical adjustment required prior to each measurement. In the current work, effort has been made to reduce the delay before the measurement.

The current LIBS system is based on an existing INNOLAS Q-switched Nd:YAG laser (450mJ in 6ns, 532nm, 10Hz) and has been established on the plasma exposure chamber on PSI-2. The measurement starts at 0.1 – 1 second, which is a significant improvement to the previous measurement. This laser can also be used for postmortem analysis when the optical path is adjusted to the exchange chamber.

The LIBS results are also compared to TDS and NRA measurements. The TDS and NRA were performed 2-3 weeks after the sample was exposed in PSI-2. The TDS result showed that the remaining D on W surface was in the range of 5×10^{16} D/cm². The NRA result showed that most of the D was detected within the depth of 1 μ m. The postmortem LIBS signal was 1000 counts ($D\alpha$ line) per pulse in a crater of $\varnothing 1$ mm \times 25nm. This gives an early estimation of 1014 to 1015 D/LIBS measurement. Improvement of the LIBS detection sensitivity is undergoing and further calibration using the lab sphere will be used as a reference.

Presenter: JIANG, Xi (FZJ)**Session Classification:** P3