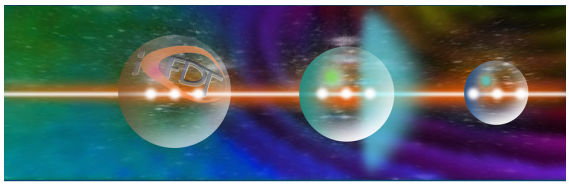

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# LIBS Application on JET and prospects for ITER

*Monday, 21 October 2024 13:10 (10 minutes)*

In JET and future fusion reactors, thick co-deposited layers will be formed on their inner walls during extended plasma operations. Experiments in present-day fusion devices indicate these layers to consist of eroded plasma facing materials, various impurities in the edge parts of the fusion plasma, and actual plasma fuel species deuterium and tritium. Monitoring the inventory of the radioactive tritium in the reactor vacuum vessel is a particularly critical safety issue. LIBS is one of the few techniques available for monitoring the tritium content and the composition of co-deposited layers during fusion reactor operations and maintenance breaks. Feasibility of a LIBS-based tritium monitoring diagnostics developed at ENEA for fusion reactors is presently being investigated at the JET tokamak in the UK.

At VTT, together with the European collaborators, we have actively participated in the JET project and developed methods to assess the amount of deuterium and tritium in plasma facing components removed from JET and other fusion devices. Our LIBS system is capable of handling all kinds of materials, including the toxic beryllium which has been used as a wall material at JET. Different quantification approaches such as calibration-free LIBS have been successfully tested and reported in laboratory conditions. Test measurements have been performed at VTT using the LIBS enclosure developed at ENEA. Both pure metallic samples and JET limiter and divertor samples have been characterized. Final setup of the LIBS system has now been commissioned at JET including the high resolution Littrow spectrometer and the photomultipliers. Presently the LIBS enclosure is being mounted on to the MASCOT telemanipulator robot which is a two-armed machine with back-drivable actuators and a large dexterous workspace. Each arm can operate within the full 6 degrees of freedom. The MASCOT manipulator is remotely operated from the control room. The LIBS experiment will be performed at JET in August 2024 and aim is to analyse ~960 locations on the main wall and the divertor.

Finally, prospects for ITER will be discussed.

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