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In situ Measurement of H, D, T Retention in the JET Tungsten Divertor Components - Lessons Learned for the ITER LID-QMS Diagnostic

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It is important to monitor the retention of hydrogen isotopes at PFCs with respect to tritium due to radiation safety, w.r.t. the fusion fuel (D, T) due to the fuel cycle and for all hydrogen isotopes due to their material degradation effect. In 2023 a new in situ retention diagnostic has been installed on JET [1] and its first quantitative results will be presented here.

The diagnostic relies on Laser-Induced Desorption that thermally releases retained gases and their detection by Quadrupole Mass Spectrometry – thus called LID-QMS. The detection limit was so low that we detected the long-term D retention from each individual laser spot of 3 mm diameter along the whole poloidal scan of the upper inner divertor of JET. Then, during the DT campaign even the low T amount of one week of DT operation was detected due to a fast laser raster mode. This allowed to monitor the T retention every week and after the DT campaign the T depletion due to different T removal techniques was observed by repetitive LID-QMS measurements. Hence, this diagnostic not only allows direct access to retention physics and identification of high retention areas, but also the assessment of T removal techniques.

Therefore, LID-QMS is already under design as Tritium Monitor Diagnostic for ITER benefitting from the lessons learned at JET. Similarities and differences to the application at JET will be shown and new challenges at ITER will be discussed.

[1] M. Zlobinski, et al. Nucl. Fusion 64, 086031 (2024), doi:10.1088/1741-4326/ad52a5