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Erosion and deposition in the JET divertor during the ITER-like wall campaigns

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During JET operation with all carbon walls prior to 2010 (JET-C) massive re-deposition of previously eroded carbon was observed in the divertor and in remote divertor areas. This massive carbon re-deposition was accompanied by a high retention of hydrogen isotopes trapped by co-deposition. Extrapolations of these results to ITER predicted very high potential tritium retention, resulting in the decision to remove carbon from the ITER divertor.

One aim of the JET ITER-like wall (JET-ILW) project was to study plasma-surface interactions in a carbon-free beryllium/tungsten environment comparable to the ITER material configuration. All divertor tiles were manufactured either from tungsten coated carbon-fibre composite (CFC) material or from bulk tungsten. Erosion and deposition in the JET divertor were studied during the campaigns JET-ILW1 (2011-2012), ILW-2 (2013-2014) and ILW-3 (2015-2016) by using specially prepared divertor marker tiles using W/Mo marker layers, which were analysed before and after the campaign using elastic backscattering of 3 and 4.5 MeV incident protons and nuclear reaction analysis using 0.8 to 4.5 MeV ^{3}He ions.

The erosion/deposition pattern observed with the JET-ILW configuration shows partly drastic changes compared to the pattern observed with JET-C: The total material deposition rate in the divertor decreased by a factor of 4–9 compared to the deposition rate of carbon in JET-C. This decrease of material deposition in the divertor is accompanied by a decrease of total deuterium retention inside the JET vessel by a factor of about 20.

The erosion/deposition pattern observed during JET ILW-2 was qualitatively comparable to JET ILW-1, the observed D inventory was roughly comparable to the inventory observed during JET ILW-1. The results obtained during JET ILW-2 therefore confirm the positive results observed in JET ILW-1. Early results from JET ILW-3 also indicate agreement; more details will become available in summer 2018.

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