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Overview of Fuel Inventory in JET with the ITER-Like Wall

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Post mortem analysis of components removed from the JET ITER-like wall (JET-ILW) provides an overall picture of long term fuel inventory. Results from the first 2011-12 (ILW-1) and second 2013-14 (ILW-2) JET-ILW campaigns are now available making a comprehensive overview possible. Overall plasma times for ILW-1 and ILW-2 are similar: ˜ 6 hours limiter plasma and ˜14 / ˜13 hours divertor plasma; however variation in strike point distribution influences overall material migration and fuel retention.

Following ILW-1, the global long term fuel retention in JET-ILW is ˜0.2% of injected fuel (deuterium, D) - at least an order of magnitude lower than the carbon wall configuration. Of this ˜65% of the retained fuel is found in the divertor, with the remaining inventory located in the main chamber. Fuel retention at the inner divertor, 17 × 1022 D atoms, occurs predominantly by co-deposition. The main deposition area is at the inner top horizontal surface where deposits > 20 µm after ILW-2 are found. Overall the outer divertor surfaces remain a net erosion zone and have a lower fuel inventory, 3.9 × 1022 D atoms. Fuel retained on the bulk tungsten load bearing plate at the base of the divertor is ˜5 × 1021 D atoms following ILW-1. This contributes only a small inventory to the divertor and is consistent with the surface being a net erosion zone. In the remote divertor corners deposition occurs by line of sight transport of neutrals sputtered from the SP; this demonstrates the influence of SP location on remote material migration. Analysis also shows that deposition and fuel retention is higher in the outer corner than the inner corner.

The total fuel inventory of plasma facing tiles in the main chamber contributes ˜30%, 8.7 × 1022 D atoms, to the vessel inventory. Recessed areas whilst having a relatively low concentration of fuel can contribute significantly due to the large areas involved. Since the recessed areas do not interact with plasma ions, the fuel retention is due to implantation of charge exchange neutrals. Overall recessed areas and gaps in tiles contribute >30% of the main chamber inventory, 4.6 × 1022 D atoms, with the recessed inner wall making the largest contribution.

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