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EX/P5-04: Longterm Evolution of the Impurity Composition and Transient Impurity Events with the ITER-like Wall at JET

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In ITER a beryllium (Be) first-wall and a tungsten (W) divertor withstanding high heat-flux area are planned to be used.
This contribution focuses on the evolution of impurities during the recent campaigns in JET with the ITER-like wall (ILW) their sources as well as material migration and possible implication for plasma operation due to spurious impurity events. The evolution of Be, W and carbon (C) as well as other trace elements was investigated by in-situ measurements with optical spectroscopy.
For Be experimental results confirm the generally observed migration pattern in devices with lower single null configuration characterized by the main chamber wall and outer divertor as areas subject to net erosion of plasma exposed surfaces and migration of eroded material predominantly to the inner divertor. The characteristic time scale for the main wall Be source reaching steady state was found to be ˜100s.
The C influx from the divertor decreased by a factor 4 in the first 2000 plasmas seconds, and stayed almost constant since then in comparable weekly performed monitoring discharges. Dedicated CFC/ILW comparison discharges in L-mode revealed a reduction of the CII emission in the outer divertor leg of about a factor 5-10.
Trace impurities such as oxygen (O) and argon (Ar) are mainly observed via high ionization stages in the main plasma as local spectroscopy shows O and Ar only in minor quantities. Oxygen was observed to be decreasing significantly (factor ˜7) during the initial operation (120 pulses) while long breaks such as weekends lead to a re-appearance, which is overcome after ˜3 plasma discharges reaching a low steady state level. Compared to the CFC operation of JET the steady oxygen levels decreased by a factor of 3-10 due to Be acting as an oxygen getter. Dedicated experiments on W sputtering have been performed during ICRH heated L-modes as well as low-power H-Modes. The W erosion flux is determined by spectroscopy of W/W+ evolving along timescales comparable to Be.
Initially irregular impurity events occurred during all plasma scenarios, but the frequency decreased strongly with operational time. These events, probably small particles or dust, occur with a typically rise time of ms and lead to a long lasting increase (˜s) in radiated power. The observed radiation is mainly due to iron, nickel and tungsten.

Country or International Organization of Primary Author

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