Core-SOL modelling of neon seeded JET discharges with the ITER-like wall
G. Telesca\(^1\), I. Ivanova-Stanik\(^2\), R. Zagórski\(^2\), S. Brezinsek\(^3\), P. Drewelow\(^4\), C. Giroud\(^5\),
A. Huber\(^3\), M. Wischmeier\(^6\) and JET contributors\(^\ast\)
EUROfusion Consortium, JET, Culham Science Centre, Abingdon, OX14 3DB, UK

\(^1\)Department of Applied Physics, Ghent University, B-9000 Gent, Belgium
\(^2\)Institute of Plasma Physics and Laser Microfusion, Warsaw, Poland
\(^3\)IEK-4, FZ Jülich GmbH, TEC, Jülich, Germany.
\(^4\)Max-Planck-Institut fuer Plasmaphysik, D-17491 Greifswald, Germany.
\(^5\)CCFE Culham, Abingdon, Oxon, OX14 3DB, UK
\(^6\)Max-Planck-Institut fuer Plasmaphysik, D-8578 Garching, Germany.

For a full metal device like JET with the ILW, impurity seeding is an essential technique to reduce the power load to the targets, via enhanced edge radiation. Among quite a number of experiments recently carried out at JET to implement impurity seeding scenarios, two series of pulses have been selected for a thorough study of the main transport and radiation features of neon seeding discharges. Both experiments were performed with vertical target configuration, at low and high delta, at \(I_p = 2.5\) MA and \(B_t = 2.7\) T.

At high delta, the D puffing rate as well as the auxiliary heating power was kept constant (at about 23 MW), while the neon seeding rate was increased pulse by pulse. This leads not only to the increase of the total radiated power but also to the increase of the ratio between the radiated power in the SOL \((P_{rad}^{\text{SOL}})\) to the radiated power in the core \((P_{rad}^{\text{core}})\). (Please, note that, from bolometric signals, the core radiation is predominantly emitted at the edge of the confined plasma). For low delta, the auxiliary heating power was increased from about 21 MW to 28.5 MW, leading to the increase of \(P_{rad}^{\text{core}}\), at nearly unchanged radiated power fraction \((frad)\). Numerical simulation of these discharges is being made in view of clarifying the main transport and radiation mechanisms of neon seeding at JET.

For the simulations we have used COREDIV code, which self-consistently couples the plasma core with the plasma edge and the main plasma with impurities. In particular, the code has proved its capability of reproducing the main features of the core as well as of the SOL JET discharges both with carbon and with the ILW [1]. Production as well as flushing out of W due to ELMs is not accounted for in the model. Indeed, a steady state W sputtering source is “simulated” in the presently used steady-state version of COREDIV. In fact, an “ad hoc” increase in COREDIV of the W yield by a factor of about 1.5 is sufficient, for the most common ELMy discharges, to lead to a good match between calculated and time-averaged experimental W fluxes and concentrations [2].

Although the work is ongoing, preliminary results suggest \(i)\) the increase of core radiation with increasing input power appears to be caused by larger W thermal sputtering while \(ii)\) the increase of the ratio of \(P_{rad}^{\text{SOL}}\) to \(P_{rad}^{\text{core}}\) with increasing Ne seeding might involve changes in main plasma recycling, possibly due to changes in SOL perpendicular transport and/or edge density, as will be discussed in the paper.


\(^\ast\) see the Appendix of F. Romanelli et al., Proceedings of the 25th IAEA Fusion Energy Conference 2014, Saint Petersburg, Russia.