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TH/P4-17: Simulations with COREDIV Code of DEMO Discharges

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The reduction of divertor target power load due to radiation of sputtered and externally seeded impurities in fusion reactor is investigated in this paper. The approach is based on integrated numerical modelling of DEMO discharges using the COREDIV code, which self-consistently solves 1D radial transport equations of plasma and impurities in the core region and 2D multifluid transport in the SOL. The model is fully self-consistent with respect to both the effects of impurities on the alpha-power level and the interaction between seeded and intrinsic impurities. The code has been already successfully benchmarked with the data from present day experiments (JET, ADEX).
Calculations have been performed for inductive DEMO scenario and DEMO Steady-State configuration with tungsten walls and Ar seeding. In case of DEMO Steady-State scenario strong increase of Zeff and significant reduction of the alpha power are observed with the increase of Ar influx which is caused by the decrease of fuel ions density due to the dilution effect. It leads to the reduction of the target plate heat loads but surprisingly the radiation level remains almost constant with the increased seeding which is the result of the interplay between the energy losses and tungsten source due to sputtering processes. It has been found that the W radiation is the dominant energy loss mechanism and it accounts for 90% of all radiation losses.
In case of pulsed DEMO scenario, it appears that the helium accumulation might be a serious problem. Even without seeding the resulting Zeff is very large (>2.6) and consequently only relatively weak seeding can be applied for pulsed scenario. It is found that helium accumulation depends strongly on the transport model used for helium, if the helium diffusion is increased than the accumulation effect is mitigated.

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