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Study of Impurity Transport in the SOL and Divertor Regions based on Extended Five-Point Model

The dynamics of the plasma in the scrape-off layer (SOL) is important for understanding complex behavior of tokamak plasmas because it determines heat exhausted to the plasma-facing components. This will subsequently regulate the amount of impurities released from the surfaces. Furthermore, it has been demonstrated in simulations and experiments that the transport in the SOL region is not symmetric due to ballooned transport. To simulate the plasma in this region, one may reduce the complexity of the problem by analyze the transport along a magnetic field line. In this work, we extend the dynamic five-point model to include the effect of the impurity transport in the SOL and divertor regions. The model is based on the multifluid equations and specifically considers plasma characteristic at five points along the opened field lines: two points at divertor surfaces, two points in front of the divertor regions, one point at the stagnation point. This extended five-point model can self-consistently provide the boundary conditions for simulating the plasma in the core. The Core-SOL-Divertor model will be a useful and effective method to simulate complex plasmas in both core and SOL regions. The simulation result based on this scheme will be evaluated with experimental results from QUEST, PLATO, WEST, and other tokamak, based on availability of the data.

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