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Initial studies of HL-2M divertor operation under consideration of the effects from pumping

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As a modified device of HL-2A, HL-2M is a new medium-sized copper-conductor tokamak with the ability to generate multiple types of advanced divertor configurations [1]. Understanding the impact of pumping on particle removal process and divertor conditions is critical for predicting the performance of HL-2M divertor operation. To address this need, the L-mode deuterium plasma simulations were conducted in conventional lower single null divertor configurations with various arrangement of pumps. In this study, these plasmas are simulated with SOLPS-ITER [2][3], in order to predict the neutral behaviors in the plenum with similar fashion to the realistic situations.

First simulations have been performed with the pumping port located in low field side which is the most possible design position of HL-2M pump duct entrance. With simplified collisional approach (EIRENE), the coupled models, which are based on the fundamental investigation considering the various capture coefficients, have been applied. These modelling studies highlight the influence of the pumping efficiency on the particle and power balance in the scrape-off-layer associate with operation parameters, the temperature and plasma heat fluxes at the target plates and the wall, and the peculiarities of neutral particle transport in the edge plasma and non-plasma region. With increase of the pumping speed, the power load at the targets increases due to the improved pumping efficiency by compressing the neutrals in front of the pump duct entrance. It is observed that the fuelling is balanced by appropriate pumping and the pumping is an effective approach to provide the control for neutral recirculation.

As a contrast, the pumping port located below the dome is employed to investigate the neutral flow pattern. With two different positions of the pumping port, the neutral flows have been discussed from the density and velocity of both atoms and molecules point of view. It is shown how the position of the pumping port influences the neutral gas compression and neutral confinement in the divertor.

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