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Simulations of SOL-Divertor Plasmas in EAST by using SOLPS-ITER

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Research at the experimental advanced superconducting tokamak (EAST) is strongly focused on preparations for the exploitation of ITER. Developing or using tokamak modelling tools and technology on EAST is one of key issues for plasma simulation. SOLPS-ITER sponsored by ITER Organization represents a renewed coupling of the neutral Monte-Carlo code Eirene and B2.5 edge plasma fluid code and can be used for the simulation of SOL-Divertor plasmas in EAST with Carbon or Tungsten divertor.

Profiles of plasma parameters at targets in the shot with Carbon divertor

The default physics models are employed for the simulation. D^0, D^{+1}, e^- and Carbon impurity species sputtered from the first wall are included in the multi-fluid SOLPS-ITER simulations. The atomic processes, including ionization, recombination and charge exchange, are taken into account. The cross-field transport coefficients in the outer core, SOL are respectively adjusted in order to match better the experimental measurement at the target plates, a ballooning effect on the transport coefficients is introduced. The computational profiles of plasma parameters at the targets have been compared to the experimental measurement in the experimental shot.

Tungsten impurity transport with Tungsten divertor

EAST was equipped with W-coated divertor plates and dome for the upper divertor, the remaining plasma facing components include the plasma facing components at lower divertor still consisted of Carbon materials, at the baffles and main chamber walls consisted of Molybdenum materials. Major points of interest were the study of tungsten impurity transport in the plasmas by the simulation. The density profiles of all species of tungsten neutral and ions W^{+q} can be obtained in the simulation. The simulation results show that the low q tungsten ions are mainly distributed in the region near the target plates and the first wall, where there is a lower plasma temperature, and tungsten ions can only be ionized to lower valence states. The high q tungsten ions are mainly distributed in the core, where there is a higher plasma temperature, and high q tungsten ions are only generated by ionization at relatively high plasma temperatures.

Radiative divertor with impurity seeding for W impurity control

The challenge of operating safely on W divertor in a high power, high stored energy device can be crudely separated into plasma scenario issues, in which the concern is for stationary power handling and tolerably low core W concentrations. The technically feasible limit of heat flux on the target plate for stationary operation in EAST with W divertor is about 7-10 MW/m^2, therefore additional radiation losses are required to decrease the power flow to the target. Impurity seeding is used in the simulation of the radiative divertor. The simulation results show that with the increase of impurity seeding rate the heat fluxes to the target plates and the density of W impurity in the plasma decrease.

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