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# Tungsten impurity screening and its control using different gas injection on EAST with full tungsten divertor

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Tungsten (W) impurity contamination is a key issue for long-pulse high-performance plasma operation in tokamaks with W plasma-facing materials. To reduce the W impurity level in the core plasma, it is important to understand the physics processes of W impurity source and edge transport.

Dedicated gas puffing experiments were carried out on EAST tokamak with full W divertor to achieve divertor detachment and evaluate the W impurity transport under different divertor conditions [1]. Ne and $D_2$ injection from the divertor target were observed to have different impacts on the edge W screening. Before the onset of divertor detachment, Ne seeding increases both the W source and the W leakage rate, while $D_2$ puffing helps to reinforce the W screening in the edge plasma. Based on the EAST experiments, W impurity transport processes from the divertor target to the core plasma are quantitatively analyzed by sequential SOLPS-ITER and DIVIMP simulations [2] with drift velocities included. Simulation results reveal that, for the $D_2$ puffing cases, the increase of the friction and the decrease of the ion temperature gradient force near the divertor target are the main reason for the enhancement of edge W screening during the transition from the high recycling regime to detachment. However, when increasing the Ne injection rate, the friction and the ion temperature gradient force vary little, and a higher Ne concentration can lead to more W erosion which finally makes more W leakage to the core plasma. The E×B drift can dramatically enhance the W leakage ability for both $B_t$ directions, but the enhancement effect becomes weaker when the divertor is detached. With the help of drifts, W leakage from the PFR to the upstream or core plasma by diffusion near the X point is proved to be significant, especially for the divertor condition with good SOL screening. Modeling results also reveal that there exists an impurity flow reversal in the near-SOL region due to the E×B drift under the pronounced detached condition. This kind of flow reversal plays an important role in impurity distribution and will be discussed in the presentation.

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References

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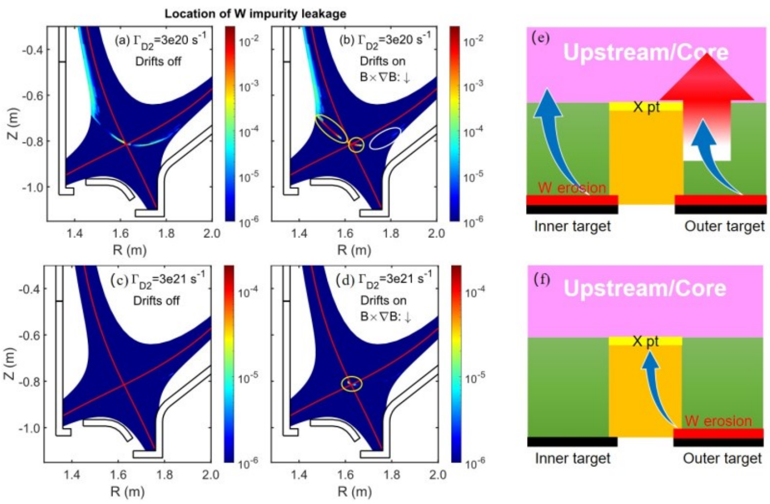


**Figure 1** Location of W impurity leakage out of divertor region from SOLPS-DIVIMP modeling for high recycling regime (a) without drift and (b) with drift, and detachment regime (c) without drift and (d) with drift. The leakage channels are shown in (e) for high recycling regime and (f) for detachment regime.