Impurity sputtering and SOL transport for mixed-material walls in ITER*

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The mixed-material (C, W, Be) aspect of the ITER wall may have important operational consequences owing to the sputtering of these different wall impurities, their subsequent spatial transport, and their eventual redeposition at various locations of the wall and divertor. The characteristics of the edge plasma in the far scrape-off layer (SOL) are needed for evaluation of these processes. The 2D UEDGE transport code is extended to include both lower and (more remote) upper X-points to model the edge plasma, showing a strong interaction on the wall at the top of the machine as well as on the W-baffle region just above the lower divertor. In addition, the influence of possible strong convective radial transport, i.e., plasma “blobs” is analyzed. The charge-exchange neutral hydrogen flux to the wall can be a significant cause of sputtering that is evaluated with the DÉGAS 2 Monte Carlo neutral code. The impurity level in the edge plasma and the spatially dependent redeposition fluxes of different impurities are modeled from the multicomponent fluid model using approximate sputtering rates. The fluid results are also compared to the WBC ion Monte Carlo code for edge impurity transport. The WBC model includes a more detailed sputtering model and kinetic effects that can be important in the low density of the far SOL.

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