Contribution ID: **726** Type: **Poster**

TH/3-2: On Edge Plasma, First Wall, and Dust Issues in Fusion Devices

Thursday, 11 October 2012 08:30 (4 hours)

The processes in the edge plasma and first wall play crucial role in both performance and design of any fusion reactor. Here we address some major issues related to the physics of the edge plasma, first wall, and dust in fusion devices: We present the results of 3D modeling of mesoscale-structures (blobs and ELM filaments) with BOUT++ code. We show that the onset of resistive drift wave turbulence can significantly alter ballistic propagation of mesoscale-structures; We report on the UEDGE modeling of intermittent edge plasma transport with novel approach which is based on self-consistent modeling of a sequence of macro-blobs appropriately launched from the core/edge interface and propagating through the edge and SOL; We present the results of the simulation of hydrogen retention in Be, performed with the codes WallPSI and FACE. We found a good agreement of the simulation results with available experimental data on hydrogen retention in Be and penetration depth of hydrogen into bulk of material for different sample temperatures; We report on the impact of the hydrogen retention in the first wall on the H-mode pedestal recovery. We show that for some parameter range the pedestal recovery can be controlled by hydrogen outgassing processes; We present the results of the simulation of the impact of dust on the performance of edge plasma with coupled DUSTT/UEDGE package for both NSTX and ITER. We demonstrate that dust injection into divertor can effectively reduce heat load to divertor plate due to radiative power dissipation without the onset of thermal instability. However, for other dust injection locations at relatively high dust injection rate (˜10 g/s for ITER-like plasmas) thermal instability develops shortly after the onset of divertor detachment causing discharge termination.

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Session Classification: Poster: P5