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Coupled Plasma-Wall Modeling with WALL-PSI/EDGE1D A.YU. PIGAROV, S. KRASHENINNIKOV, UCSD — We developed the Wall and Plasma-Surface Interactions (WALL- PSI) code which is the 1-D code for particle and heat transport inside plasma-facing components. WALL-PSI incorporated new approaches in continuum, diffusion-advection modeling of hydrogen species in wall materials. Some results on WALL-PSI benchmarking against experimental data on hydrogen retention, permeation, and erosion rates for major fusion related materials will be highlighted. To study basic physics processes, WALL-PSI was coupled to our EDGE1D code that mimics cross-field transport of plasma and neutrals in tokamaks with SOL. We report on the results of self-consistent plasma- neutrals-wall simulation showing: (1) examples of strong plasma- wall coupling, (2) nonlinear variation of hydrogen inventory and recycling coefficient vs. incident plasma flux, and (3) featured instabilities. Saturation of wall in long duration discharge without external gas pumping feedback resulted in MARFE in agreement with experiments [T.Fujita etal, Nucl. Fusion 46(2006)S3]. The modeled transitional effects include sawteeth-like oscillations in edge plasma due to switching from wall pumping to gas release. Here 20% variation in recycling coefficient corresponds to transitions between cold deeply- detached and hot sheath-limited edge plasmas due to thermal plasma instability. Work supported by DoE Grants DE-FC0207- ER54908, DE-FG0204-ER54739.

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