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Axisymmetric MHD Simulations of Pellet Ablation[1] ROMAN SAMULYAK, TIANSHI LU, Brookhaven National Laboratory, PAUL PARKS, General Atomics — A new 2D magnetohydrodynamic simulation of pellet ablation in the electrostatic approximation was developed. The main features of the model are the explicit tracking of solid pellet/ablated gas, and ablated gas/ambient plasma moving interfaces. Atomic processes in the ablation cloud are included. The major conclusion of the study is that in purely hydrodynamic simulations (without JxB force), changing the heat flux deposition from 1D spherically symmetric to 2D axisymmetric leads to a minor reduction in the ablation rate, contrary to the prevailing expectation of a "factor of 2" reduction. However, in the magnetohydrodynamic simulations (with JxB force), the magnetic field channels the flow into an extended plasma shield, and significantly reduces the ablation rate by a factor of 2 to 3, depending on the time it takes for the heat flux to ramp up as seen by a moving pellet. Fast pellets crossing pedestal regions in ITER would lead to shorter warm-up times, which in turn lead to narrower ablation channels, stronger shielding, and reduced ablation rates.

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