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Multiple-Ion Species Effects in IEC Modeling G.A. EMMERT, J.F. SANTARIUS, Fusion Technology Institute, Univ. of Wisconsin — A simple model for the effect of various molecular and atomic processes (charge exchange, ion impact ionization, and dissociation) between deuterium ions (D^+, D_2^+, and D_3^+) and the background gas on the performance of spherical, gridded IEC devices has been developed. Ions enter the intergrid region primarily as D_3^+ ions and, while being accelerated by the falling electrostatic potential, interact with the background gas to produce a source of cold ions (D^+ and D_2^+) through interactions with the background gas. These cold ions are accelerated by the potential and produce additional cold ions through interactions with the background gas. A formalism has been developed which includes the bouncing motion of ions in the electrostatic potential well and sums over all generations of cold ions. This leads to a set of coupled Volterra integral equations for each ion species. The integral equations are solved numerically, and the energy spectrum of the ion and fast neutral flux is calculated. Macroscopic quantities, such as the current collected by the cathode, and the fusion rate between ions and fast neutral atoms and molecules with the background gas, are calculated. Comparison of the results from the multiple ion species model with an atomic ion model and with experimental data for the Wisconsin IEC device will be presented. Research supported by the US Dept. of Energy under grant DE-FG02-04ER54745.

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