Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

Atomic Physics Effects on IEC Ion Radial Flow G.A. EMMERT, J.F. SANTARIUS, Fusion Technology Institute, University of Wisconsin-Madison — A simple model for the effect of charge exchange and ion impact ionization of background gas on the performance of spherical, gridded IEC devices has been developed. Ions entering the intergrid region are not only accelerated by the falling electrostatic potential, but also produce a source of cold ions through charge exchange and ion impact ionization of the background gas. Charge exchange is treated as a loss of ions with finite energy and a corresponding source of cold ions. The cold ions are also accelerated by the potential and, in turn, produce additional cold ions. 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 Volterra integral equation for the resulting total cold ion source function. The integral equation is solved numerically, and the energy spectrum of the ion and fast neutral flux is calculated from the cold ion source function. Macroscopic quantities, such as the current collected by the cathode, and the fusion rate between ions and fast neutrals with the background gas, are calculated and compared with representative experimental values for the Wisconsin IEC device. The agreement is generally good. Extensions to the model, such as multiple ion species, are being developed. Research supported by the US Dept. of Energy under grant DE-FG02-04ER54745.

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Date submitted: 21 Jul 2005 Electronic form version 1.4