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Fast Analytical-Numerical Model of Atmospheric Pressure Radio-Frequency Capacitive Discharges M.A. LIEBERMAN, A.J. LICHTENBERG, Dept EECS-1770, Univ Calif, Berkeley CA 94720, C. LAZZARONI, P. CHABERT, LPP, CNRS, Ecole Polytechnique, UPMC, Paris XI, 91128 Palaiseau, France, A. LEBLANC, ENS, Cachan, UPMC, France, JING ZHANG, Dept Appl Phys, Donghua U, Shanghai 201620, China — A fast one-dimensional analytical-numerical hybrid model of atmospheric pressure, radio-frequency (rf) driven discharges is developed. The feed gas is assumed to be helium or argon with small admixtures of oxygen, nitrogen, or other gases. The electrical characteristics are determined analytically from a current-driven homogeneous discharge model. The electron power balance is solved analytically to determine the time-varying electron temperature, which oscillates on the rf timescale. Averaging over the rf period yields enhanced rate coefficients for gas phase activated processes, an effect not usually considered in global models. The particle balance relations for all species are then integrated numerically, with assumed Maxwellian rate coefficients, to determine the equilibrium discharge parameters. The coupling of analytical solutions of the time-varying discharge and electron temperature dynamics, with the numerical solutions of the discharge chemistry, allows for a fast solution of the discharge equilibrium. Supported by Dept Energy Fusion Energy Science Contract DE-SC000193.

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