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Relaxation of High Power Microwave Surface Plasma[1] STERLING BEESON, ANDREAS NEUBER, Center for Pulsed Power and Power Electronics, TTU — The electron loss mechanisms related to the relaxation of pulsed rf-generated plasma are investigated. A 3 MW, 3 μs width, 50 ns risetime high power microwave pulse is transmitted through a dielectric window that terminates a WR-284 (S-band) waveguide filled with insulating gas where the investigated plasma is formed across this window on the atmospheric side. This produces electron densities on the order of 10^{14} cm^{-3} for pressures of 10 to 400 torr in air, N_2 and argon environments. This plasma attenuates the pulse on the order of -40 to -10 dB during peak electric field amplitudes. Using a multi-standard waveguide coupler to inject a low power probing signal, the post-pulse attenuation values are measured and used to quantify the temporal evolution of the electron density. This technique is confirmed by means of verifying the attachment rates in an air environment and 2-body recombination rate in a N_2 environment. The major recombination processes for high pressure argon plasma are identified, e.g. 3-body recombination becomes dominant within the first few microseconds after pulse termination. The measured rates for recombination are compared with sparsely available data and models from literature in the regime of interest.

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