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**Plasma Relaxation Parameters From High Power Microwave Excitation**[1] STERLING BEESON, GEORGE LAITY, ANDREAS NEUBER, Texas Tech University — The recombination/relaxation physics of plasma generated from a 3 MW, $3\mu$s pulse-width, high power microwave (HPM) pulse is investigated. This pulse is incident on a microwave transparent dielectric window which separates the source (vacuum) environment from the atmospheric test chamber (pressure and gas type are user controlled). During the pulse, the value of E/p (normalized electric field value with pressure) are sufficiently large such that plasma is formed on a time scale of 100 ns after which the plasma begins to absorb and reflect a significant amount of the power. The electron densities are on the order of $10^{13}$-$10^{14}$ $cm^{-3}$ for pressures of 10 to 400 torr in air, $N_2$ and argon environments. At these densities, the plasma attenuates the pulse on the order of -40 to -10 dB during peak electric fields. With the use of multi-standard waveguide couplers, a CW low power (a few watts) probing signal is injected into the waveguide structure. Utilizing a 1D plasma model and the transmitted power levels, the temporal evolution of the electron density after the HPM pulse is determined for many microseconds after the pulse. The technique was confirmed by benchmarking with known attachment rates in an air environment along with the 2-body recombination rate of $N_2$. This research helps facilitate the understanding of which molecular/atomic species exist during plasma formation from HPM excitation.

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