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Time-resolved microplasma excitation temperature in a pulsed microwave discharge[1] JEFFREY HOPWOOD, SHABNAM MONFARED, ALAN HOSKINSON, Tufts University — Microwave-driven microplasmas are usually operated in a steady-state mode such that the electron temperature is constant in time. Transient measurements of excitation temperature and helium emission lines, however, suggest that short microwave pulses can be used to raise the electron energy by 20-30% for approximately 100ns. Time-resolved optical emission spectrometry reveals an initial burst of light emission from the igniting microplasma. This emission overshoot is also correlated with a measured increase in excitation temperature. Excimer emission lags atomic emission, however, and does not overshoot. A simple model demonstrates that an increase in electron temperature is responsible for the overshoot of atomic optical emission at the beginning of each microwave pulse. The formation of dimers and subsequent excimer emission requires slower three-body collisions with the excited rare gas atom; this is why excimer emission does not overshoot the steady state value. Similar experimental and modeling results are observed in argon gas. The overshoot in electron temperature may be used to manipulate the collisional production of species in microplasmas using short, low-duty cycle microwave pulses.

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