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Laser Induced Fluorescence Studies of NO Kinetics in Short Pulse Air and Air-Fuel Nonequilibrium Discharges[1] WALTER LEMPERT, MRUTHUNJAYA UDDI, IGOR ADAMOVICH, Ohio State University — Laser Induced Fluorescence is used to measure absolute NO concentrations in air, methane-air, and ethylene-air non-equilibrium plasmas, as a function of time after initiation of a single 25 nsec discharge pulse. Peak NO density in air at 60 torr is $\sim 8.10^{12}$ cm^{-3} occurring at $\sim$500 μs after the pulse, with decay time of $\sim$16.5 msec. Peak NO atom mole fraction in methane-air at ϕ=0.5 is approximately equal to that in pure air with similar rise and decay rate. In $\phi = 0.5$ ethylene-air, the rise and decay times are also comparable to air and methane–air, but peak NO concentration is a factor of $\sim$2.5 lower. Spontaneous emission measurements show that N_2(C) and NO (A) decay in $\sim$25ns and $\sim 2.5\mu$s, respectively. Kinetic modeling calculations incorporating Boltzmann solver for EEDF, and electron impact and full air species kinetics, complemented with the GRI Mech 3.0 hydrocarbon oxidation mechanism, are compared with the experimental data using three different mechanisms. It is concluded that processes involving long lifetime ($\sim$100 μsec) meta-stable states, such as N_2 (X,v) and $O_2(b^1\Sigma)$, which are formed by quenching of the metastable N_2 (A) state by ground state O_2, play a dominant role in NO formation.

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