PURE ROTATIONAL CARS THERMOMETRY IN NANOSECOND PULSE BURST AIR AND HYDROGEN-AIR PLASMAS

YVETTE ZUZEEK, INCHUL CHOI, SHERRIE BOWMAN, IGOR V. ADAMOVICH AND WALTER R. LEMPERT, *Department of Mechanical Engineering, The Ohio State University, 201 W. 19th Ave., Columbus OH, 43210.*

Pure rotational Coherent Anti-Stokes Raman Scattering (CARS) is used to study low temperature plasma kinetics and ignition in a repetitively pulsed nanosecond discharge in air and hydrogen-air at stoichiometric and fuel lean conditions at 40 Torr pressure. Air and hydrogen-air mixtures are excited by a burst of high-voltage nanosecond pulses at a 40 kHz pulse repetition rate and 10 Hz burst repetition rate. The number of pulses within the burst has been varied from a few pulses to 1,000 pulses. These temperature measurements are then compared to a hydrogen-air plasma chemistry model which includes nonequilibrium plasma processes and low temperature hydrogen-air chemistry. Sensitivity analysis shows that generation of radicals by the nanosecond discharge is critical to low temperature plasma chemical fuel oxidation and associated heat release. With phi = 1.0 and phi = 0.5, a distinct maximum in temperature with respect to discharge burst duration is observed, as predicted by the code, indicative of ignition occurring.