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GAS TEMPERATURE DEPENDENCE ON PULSE FREQUENCY IN NANOSECOND-PULSE HIGH-FREQUENCY DISCHARGES

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The gas temperature within a pin-to-pin air gap discharge created by nanosecond-pulsed high-frequency voltage pulses was studied via emission spectroscopy of the N2(C-B) state. The temperature evolution was studied over a burst series of 10 pulses with the frequency varying from 1 kHz to 250 kHz. Emission from each individual discharge was studied to determine the temperature associated with each pulse. The results show that within a burst of repetitive pulses, the effects of the previous pulse caused a significant temperature increase at the ignition of the following pulse if the time between pulses was less than 0.1 ms. This indicated that the discharges were "coupled"for frequencies above 10 kHz and temperatures continued to rise throughout the burst series. At even higher frequencies, the rapid temperature rise within the burst of pulses was found to be several thousand Kelvin over a few microseconds. This type of rapid heating could be very advantageous in controlling ignition probability in a combustion system. In this work, the energy deposition is examined and related to the temperature evolution. The nanosecond-pulsed discharge coupling theory is also discussed in term of plasma parameters.

Authors: MILES, Jared (Air Force Research Laboratory); ADAMS, Steven (Air Force Research Laboratory); OMBRELLO, Timonthy (Air Force Research Laboratory); BRAYFIELD, Russell (Air Force Research Laboratory); LEFKOWITZ, Joseph (Israel Institute of Technology)

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