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Experimental electron density and temperature measurements following a high voltage nanosecond pulsed atmospheric spark discharge.

JARED MILES, STEVEN ADAMS, Wright Patterson AFB, CHASE MURRAY, AJANI ROSS, Wright State University, KRISTINA LEMMER, JACOB RUSSELL, Western Michigan University — Nanosecond-pulsed high-frequency discharges (NPHFD) have been shown to efficiently create high electron densities using less power than traditional DC discharges. To better understand the phenomenon caused by the high repetition rate, electron density and temperature measurements were taken following a single high voltage pulse and after multiple pulses applied at frequencies up to 300 kHz. The 10 ns duration pulses have peak voltages up to 15 kV and are applied to a 2 mm gap pin to pin discharge configuration open to atmospheric air conditions. Densities and temperatures were measured via Thomson scattering of a 532 nm laser, with evidence of electron densities on the order of 1E14 cm^{-3} existing 10 microseconds after the first pulse. At these relatively long times after the discharge, the electron temperature was measured to be less than 1 eV. We posit that these electrons aid in the ignition of pulse discharges that follow and allow coupling between higher repetition high voltage pulses, which have been observed in other work. Electron temperatures and densities will be presented for multiple times after the discharge in addition to data showing that the measured electrons are remnants of the nanosecond discharge and not from other sources such as photoionization.

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