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Spatially and temporally resolved electron temperature and number density measurements in 100-kHz nanosecond pulse burst discharges using laser Thomson scattering.[1] YUE WU, RICHARD MILES, CHRISTOPHER LIMBACH, Texas AM University — In order to better understand plasma transport, plasma chemistry, and energy efficiency in nanosecond repetitively pulsed (NRP) discharges, spatially and temporally resolved studies of plasma afterglows in argon with additions of carbon dioxide and water vapor have been investigated using laser Thomson scattering, laser Rayleigh scattering, and optical emission spectroscopy. Bursts of 6-ns, 14-kV pulses at 100-kHz rate (10 pulses per burst at 30 Hz) are produced in a pin-to-sphere discharge geometry at a pressure of 80 Torr. Electron temperature, electron number density, and active species have been measured within the first microsecond. Meanwhile, gas temperature has been monitored after the first microsecond with Rayleigh scattering. Selected pulses (i.e. 1^{st}, 2^{nd}, 5^{th}, and 10^{th} pulse) in each burst have been investigated in more detail. Both the dissociation of species and the increase of gas temperature played important roles in the plasma chemistry, energy deposition, and electron lifetime. The investigation on NPB discharges provides valuable insight into the nature of NRP discharges and shows fundamental differences from other nanosecond discharges operating in single-shot or low frequency mode.

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