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ELECTRON PROPERTY MEASUREMENT OF A HIGH REPETITIVELY PULSED HELIUM PLASMA JET USING LASER THOMSON SCATTERING

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The increasing use of atmospheric-pressure nanosecond pulsed plasma jets (APNPJs) in biomedical and environmental applications has motivated fundamental studies of the APNPJs including measurements of plasma properties such as the electron density and temperature. Quantifying these properties helps us to understand the roles of electrons during the initiation and development of the discharge, as well as the electron impact-related chemical kinetics resulting in generations of reactive plasma species. This study applies the laser Thomson scattering technique to resolve the spatial distribution and temporal development of the electron density and temperature in an APNPJ. A 1-mm in-width helium plasma jet was generated using a tubular dielectric barrier discharge (DBD) electrode driven by 150 ns, 7 kV pulses at a repetition rate of 4 kHz. Ring-shaped profiles, with higher values on the outer edge and lower values in the center, were observed for the electron density as the plasma jet exits the nozzle and converges as it travels away. A peak electron density of $4 \times 10^{19} cm^{-3}$ was observed at an axial distance of 7-8 mm from the nozzle surface, after convergence of the ring. In addition, comparisons of these measurements with previous studies, including the one for a low repetition rate APNPJ [1], are discussed.

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