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Thomson scattering diagnostics of atmospheric pressure plasmas - Pulsed filament discharges and plasma jets

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Recently, non-thermal atmospheric-pressure plasmas have received much attention. Because the characteristics of the plasmas are governed by free electrons, measurements of the electron density (n_e) and electron temperature (T_e) are a prerequisite for understanding plasma behavior. To contribute to the understanding of non-thermal atmospheric-pressure plasmas, we have been developing a laser Thomson scattering (LTS) technique as a diagnostic method for measuring n_e and T_e of two types of plasmas; a pulsed-filament discharge and He flow plasma jet. The pulsed filament discharge has a short current width (a few tens of ns) and a small size. In order to apply LTS to such plasmas, reproducibility of time and space of the plasmas were improved using a high-speed semiconductor switch. Spatiotemporal evolutions of n_e and T_e of a main discharge have been obtained. Now we try to apply LTS at a time of primary streamer. Regarding to the He flow plasma jet, the discharge was generated with He gas flow with N_2/O_2(20%) or N_2 shielding gas. It was confirmed that the n_e at the center of the plasma with N_2/O_2 shielding gas was around 50% higher than that with the N_2 shielding gas.

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