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GAS CONCENTRATION DISTRIBUTION NEAR SURFACE IN AN IMPINGEMENT OF ATMOSPHERIC PRESSURE PLASMA JET BY TWO-DIMENSIONAL FILTERED RAYLEIGH SCATTERING

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Due to potential applications in plasma medicine and surface modifications, atmospheric pressure plasma jets (APPJs) receives great attentions by scholars in the last decade. Recently, the plasma induced flow instability and ionization propagation along thin mixing layer have been proposed and studied experimentally and numerically [1,2]. In respect to plasma-surface interaction, the mixing near surface is even important while understanding discharge physics and chemistry. In this report, the two-dimension filtered Rayleigh scattering is adopted to study the mole concentration distribution of helium and air near dielectric surface.

The plasma jet impingement is obtained by flowing helium to dielectric surface. The laser sheet generated by high spectral purity system at 532 nm is aligned approaching to the dielectric surface. By applying the iodine cell in the observation pathway and fitting the laser wavelength to spectral absorption curve of iodine, an effective suppression of narrow-band stray light from surface is achieved, while allowing the doppler broadened Rayleigh signal through and captured by camera, which shows great advantage in plasma-surface interaction. By applying the method described above, the two-dimension mole fraction of helium and air near the surface is obtained. The error coming from laser energy variation and wavelength jitter is evaluated as well as the effect of stray light is discussed. The experimental outcomes are further compared with numerical results showing great consistency. The discharge effect on instability of mole fraction of gas is also discussed.

1. A. Lietz, E. Johnsen and M. Kushner, "Plasma-induced flow instabilities in atmospheric pressure plasma jets"Appl. Phys. Lett., 111,114101 (2017).
2. E. Doremaele, V. Kondeti and P. Bruggeman, "Effect of plasma on gas flow and air concentration in the effluent of a pulsed cold atmospheric pressure helium plasma jet"Plasma Sources Sci. Technol. 27 095007 (2018).

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