ELECTRIC FIELD MEASUREMENTS OF A KHZ DRIVEN ATMOSPHERIC PRESSURE PLASMA JET

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This presentation focuses on the axial electric field strength in the plasma plume of a helium atmospheric pressure plasma jet (APPJ). A non-perturbing spectroscopic method based on the polarisation dependent Stark effect of the helium 492.2 nm line and its forbidden component was used for these measurements. This technique can be employed for a freely expanding plasma jet as well as plasma-surface interactions. For most application purposes of APPJs, the plasma jet will be interacting with a target of some sort of dielectric profile. Current research has shown the electric field to play a large role in the plasma-surface interaction. This work aims to provide a more detailed understanding of the plasma-surface interaction.

1. Plasma Jet Details

The plasma jet used in this study is similar to that of a dielectric barrier discharge (DBD). The plasma jet consists of two copper ring electrodes, each 5mm wide and 100μm thick, wrapped externally around a cylindrical quartz tube (inner diameter: 4mm outer diameter: 6mm) vertically orientated as depicted in figure 1. The centre of the powered electrode is fixed at a distance of 22.5mm from the exit nozzle of the tube and remains separated from the grounded electrode at a distance of 27.5mm. To ignite the plasma, a high voltage (1 – 12 kV) pulsed power supply (Haiden PHF-2K) with repetition rates in the 1 – 100kHz range are applied between the two electrodes and a helium gas mixture is passed through the tube. The applied voltage is measured using a Tekronix P6015A high voltage probe and two Pearson probes monitor the current in both the high voltage cable and grounded cable. The voltage pulse produced is attenuated by the probe by 1000x before being viewed via a GHz digital oscilloscope (Tektronix TDS5104). The current waveforms are also monitored by the same oscilloscope. For the work presented here, the typical voltage supplied was 6kV at a repetition frequency of 20kHz and a helium flow rate of 2 standard litres per minute, slm. The jet extends into open air at atmospheric pressure and room temperature.

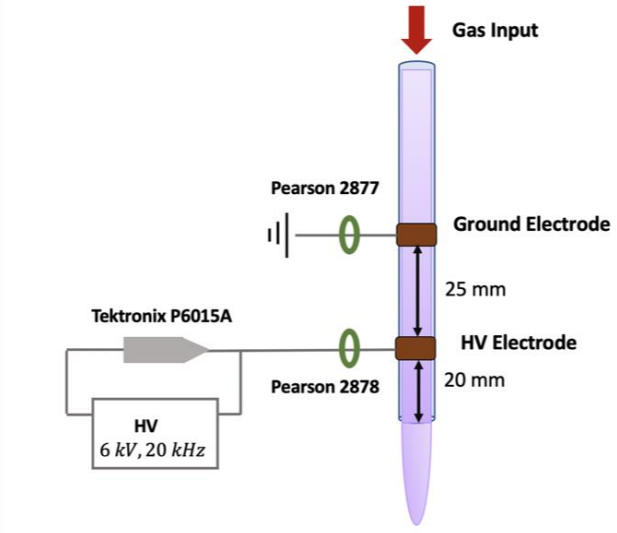

Fig. 1. Schematic of the plasma jet used in this work.