TRANSIENT SPARK DISCHARGE IN AIR

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Abstract. We have investigated a novel type of streamer-to-spark transition discharge in air at atmospheric pressure named the transient spark (TS), applicable for flue gas cleaning or bio-decontamination. Despite the DC applied voltage, TS has a pulsed character with short (<100 ns) high current (>1 A) pulses, with repetitive frequencies of a few kHz. The emission of N_2 2nd and 1st positive, N_2^+ 1st negative, and atomic N and O lines, was detected. The non-equilibrium character of TS was confirmed by calculated vibrational (3000-5000 K) and rotational (500-1500 K) temperatures. Additionally, temporal emission profiles were obtained using PMT measurements.

1. INTRODUCTION

Atmospheric pressure plasmas in air generated by electrical discharges present considerable interest for a wide range of environmental, bio-medical and industrial applications, such as air pollution control, waste water cleaning, bio-decontamination and sterilization, or material and surface treatment. New types of discharges are therefore still being developed and studied, with a focus on efficiency, power requirements, stability, reliability and simplicity.

Besides measurements of electrical discharge parameters, optical emission spectroscopy (OES) in UV□VIS regions is widely used for plasma diagnostics. It provides valuable information on excited atomic and molecular states, enables to determine the rotational, vibrational, and electronic excitation temperatures of the plasma and thus the level of non-equilibrium and the gas temperature [1,2]. In addition, it enables to identify many radicals and active atomic or molecular species and so gives insight in the plasma chemical processes. This enables understanding and optimizing air or water pollution control processes [3].

2. EXPERIMENTAL SETUP

Experiments were carried out at room temperature in atmospheric pressure air with an axial flow of 10 l/min. The distance between stainless steel needle electrodes in point-to-point configuration varied from 3.5 to 5 mm. A DC High Voltage (HV) power supply HCL 14-20000 connected via a series resistor (R = 10 MΩ) limiting the total current was used to generate a positive TS discharge. The discharge voltage was measured by a high voltage probe LeCroy PMK-14kVAC and the discharge current was measured using a Pearson Electronics 2877 (1V/A) current probe linked to a 350 MHz digitizing oscilloscope LeCroy Waverunner 434 (maximum 2GS/s).

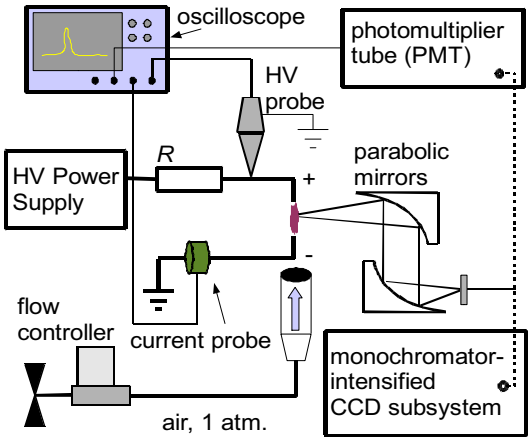

FIGURE 1. Schematic of the experimental set-up, HV - high voltage, *R* - resistor.

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