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平板型静電プローブを用いたキャピラリー大気圧プラズマジェットの時間・空間分解計測

Measurement for Time and Spatial Resolution of Capillary Atmospheric Pressure Plasma Jet by Using Planar Electrostatic Probe

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1. Introduction

The non-equilibrium atmospheric pressure plasma jets (APPJs) is one of the interesting plasma technology due to technically simple and no need expensive vacuum equipment. APPJ plays an important role in the modification for a wide range of materials, such as carbon nanotube, protein film, and polymer substrate. The big advantage of the APPJ is the fact that it can create the necessary reactive moieties that can enrich the materials with new functionalities and thus can be later use as sensing platform for new types of biochip devices.

In this study, planar electrostatic probe measurement was carried out to get better understanding of time and spatial behavior of APPJs.

2. Experimental details

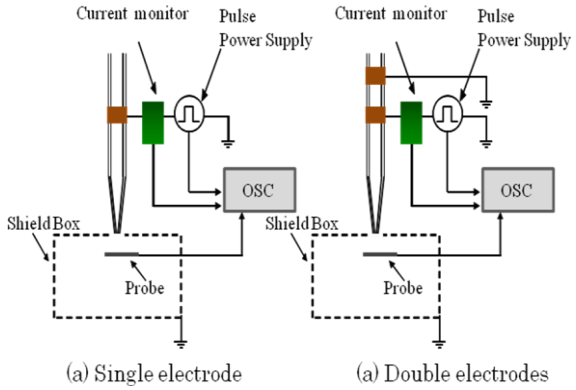

Fig. 1 The schematic of the experimental setup: (a)Single electrode, (b)Double electrodes

The schematic of the experimental setup is shown in Fig. 1. For the experiment, (a) single electrode and (b) double electrodes of APPJs are analyzed by planar electrostatic probe measurement. In addition, He gas was used as working gas, and high voltage of ±5 kV with a frequency of 5 kHz and a duty ratio of 50% was employed to generate the plasma. The inner diameter of the both APPJ tip is 5 µm and the distance between the tip and probe is approximately 500 µm. Current-voltage measurements are obtained using a Tektronix (DPO 4104B-L) digital oscilloscope connected to a Tektronix (P6015A) high voltage probe on power electrode line, a Pearson (4100) current probe on power electrode line, and planar electrostatic probe on exit tip of APPJ as shown in Fig. 1.

3. Results and discussion

Fig. 2 shows that typical voltage and current waveforms of the APPJ discharges. The electrostatic probe signal was not detected when the hole of shield box was filled up or the voltage was applied without flowing He gas. Therefore the signals are expected to be charged bullet of APPJs.

Compared with two electrode structure of APPJs, the probe signal generated after the peak of displacement current in case of the double electrodes is later than that of the single electrode APPJ as shown in Fig. 2. The detail results will be presented at the conference site.

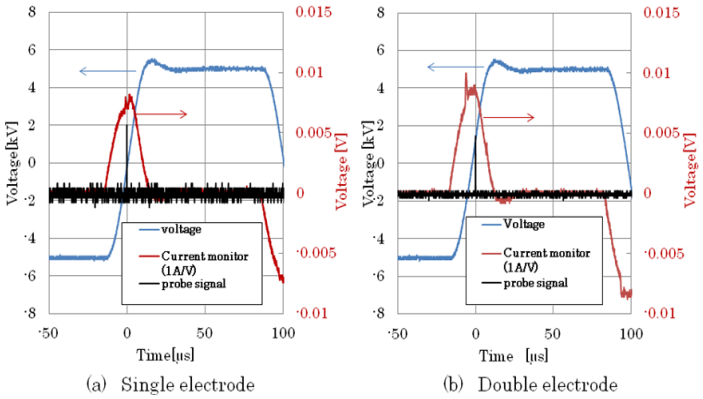

Fig. 2 Probe signals in the one cycle of drive voltage of each APPJ with voltage and current waveforms: (a)Single electrode, (b)Double electrodes.

4. Acknowledgement

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