パルスマイクロ波励起大気圧長尺スロットプラズマの時分解計測

Time-resolved Measurement of Pulsed-microwave Excited Atmospheric-pressure Long-scale Slot Plasma

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1. Introduction

Atmospheric pressure (AP) microwave plasma is attracting increasing attention as an easy method of generating high density and low temperature plasma. Utilizing travelling wave, our research group have successfully achieved to produce a meter-scale AP microwave plasma and, have demonstrated its surface treatment application [1]. In order to further enhance the capability of this device, it is necessary to lengthen the plasma, and to increase electron density and electron temperature as well as to generate active species. However, plasma generation mechanism of this device is still unclear. This research investigates the mechanism of plasma generation by pulsing the microwave input power and aims at controlling electron density and temperature. In this work, details of the time-resolved measurement of the line plasma are reported.

2. Experimental Setup

In the experiment, pure Ar at a gas flow rate of 14.4 slm was introduced into a gas-sealed waveguide with a slot of 1000mm in length and 0.15mm in gap width and microwave power (2.45GHz, pulse frequency 20kHz, and duty cycle 50%) was applied. Plasma was generated in the slot, in front of which a layer of copper mesh was installed for shielding the microwave. Time-resolved pictures of the AP pulsed-microwave line plasma were taken using Hamamatsu Photonics CCD camera. Gate-width of the CCD camera was set at 20ns.

3. Experimental Result

Fig. 1 shows plasma light emission at 0, 100, 200, 300ns after pulse rise, depicting the spatial growth of plasma along the slot. The microwave power is supplied from the left of the images. Although the plasma structure from the images looks discontinuous due to the mesh shield, uniform plasma production was confirmed. Fig. 1 shows the plasma expansion from the power upstream side to the downstream at a speed of approximately 0.9×10^6 m/s.

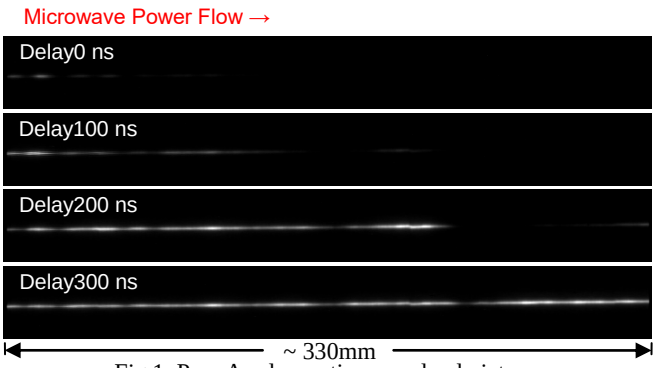

Fig.1. Pure Ar plasma time-resolved pictures

[1] H. Suzuki: 10th Int. Workshop on Microplasmas (Kyoto, 2019)

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