04aE05P

バブル生成多孔質セラミック電極を用いた 水中パルスプラズマ放電の時間分解分光計測

Time-resolved optical emission spectroscopy of pulsed plasma discharges inside water using a bubble-generating porous ceramic electrode

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1. Introduction

So far, there have been many researches on the production of plasma discharges inside the liquid to apply them for medical applications, new materials fabrication, environmental applications such as purification of waste water and decomposition of toxic materials, and so on. To produce plasma inside the liquid medium, a common technique is to introduce the micro-bubble inside the liquid between the electrodes driven by high voltages. In our laboratory, we have developed a multi-bubbles discharge system for wastewater treatment by using a porous ceramic sheet clutched over a hollow metallic frame[1]. In this study, we have carried out the time-resolved optical emission spectroscopy using ICCD camera to understand the phenomena of bubble discharges.

2. Experimental set up

For bubble generation, usually an external source is used, but we introduced a novel complex electrode made up of a porous ceramic plate clutched by a metal frame having a gas hoarse inlet.

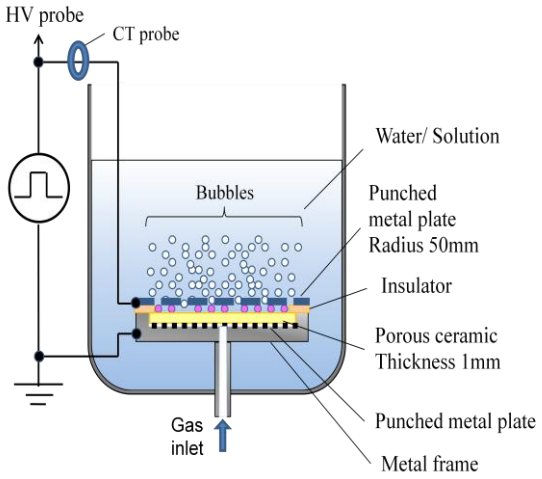

Fig. 1 Experimental set up.

Figure 1 shows the schematic diagram of the experimental set-up. We used Ar gas at flow rate of 250 sccm. Squared-wave pulses with a frequency of 5 kHz and pulse width of 750 ns was applied between electrodes. Voltage amplitude was varied up to 4 kV. Applied voltage and current waveforms were measured with a high-voltage probe(Tektronix, P6015A) and current transformer (Pearson, model 4100), respectively. The behavior of bubbles inside water and the characteristics of the plasma are studied by ICCD camera and optical emission spectrograph.

3. Results & disuccusion

Figure 2 shows the averaged waveforms of optical emission intensity measured during one pulse duration, together with applied voltage and current. It is seen that the optical emission appeared at the time of voltage drop and observed during the decay period of voltage waveform. From the CCD images, it is found that the discharges are randomly distributed over the surface of punched electrode.

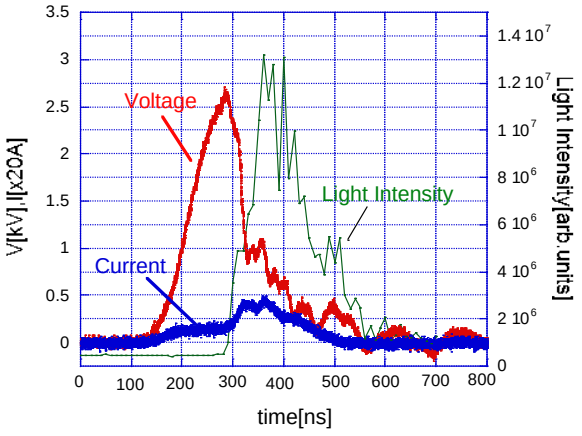

Fig. 2 Typical averaged waveforms of optical emission intensity, applied voltage and current.

Reference

[1] S. Muradia and M. Nagatsu, Appl. Phys. Lett. 102 (2013) 144105 (4 pp).