Study on the Generation Rate of Chemical Reactive Species in Dielectric Barrier Discharge depending on External Flow Rate

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The generations of chemical reactive species, such as O_3 and NO, were investigated in dielectric barrier discharge (DBD) plasma depending on different external air flow rates. The generations of O_3 and NO are a function of gas temperature in the plasma volume and the gas temperature can be affected by the air flow. The generation rates of O_3 and NO were measured using gas analysers and the gas temperature is assumed from the temperatures of electrode. The gas flow distributions were visualized using background-oriented schlieren (BOS) as the external air flow rate varies from 0 to 20 lpm. As the air flow rate was increased, the generation rate of O_3 was increased from 0 to 3.61 mg/min. In the contrary, the generation rate of NO was decreased from 0.21 to 0 μg/min.

1. Introduction

It is important to use appropriate chemical reactive species to obtain the effective results for specific applications. For example, O_3 has been explored for enhancement of agri-food preserving efficiency [1] and NO for prevention of agri-food ripening [2].

2. Experimental Set-up

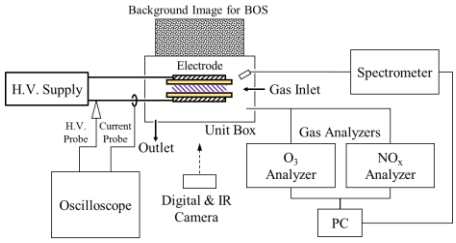

Figure 1. Experimental Set-up

The experimental set-up for measurements of generation rate is described figure 1. The generation rates of O_3 and NO were measured by using the gas analysers depending on the variation of external air flow rates from 0 to 20 lpm.

There are two method were performed to analysis of a correlation between the external air flow rate and gas temperature. Due to the limitation on the direct measurement of gas temperature in the plasma volume, the gas flow distributions were visualized by background-oriented schlieren (BOS) [3] and the temperatures of electrode were taken by IR camera.

3. Experimental Results

The generation rates of O_3 and NO, temperatures of electrode and visualizations of gas flow depending on the different external air flow rate were depicted as shown in the figure 2(a), 2(b) and 3, respectively. As external air flow rate was increased, the generation rate of O_3 was increased from 0 to 3.61 mg/min. In the contrary, the generation rate of NO was decreased from 0.21 to 0 μg/min.

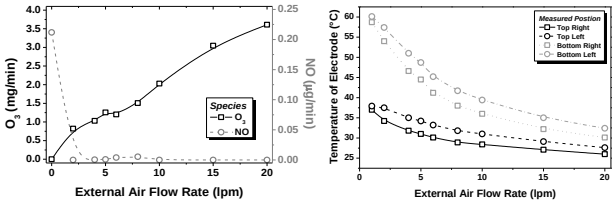

Figure 2. Generation rates of O_3 and NO (a) and temperature of electrodes (b)

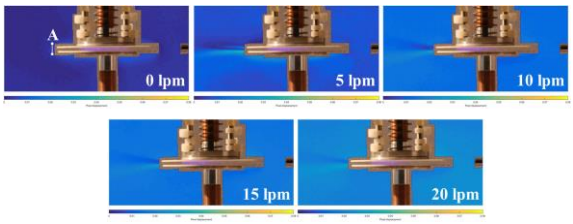

Figure 3. Background-oriented schlieren images

4. Discussions

In order to understand the influence of external air flow rates on the generation of O_3 and NO more precisely, follow-up research, such as simulation for numerical analysis, is needed.

5. Acknowledgement

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6. Reference

[1] Horvitz S. and Cantalejo M. J., Crit. Rev. Food Sci. Nutr. **54** (2014) 312–39

[2] Eum H. L., Lee E. J. and Hong S. J., Kor. J. Hort. Sci. Technol. **32** (2014) 666–72

[3] Hargather M. J. and Settles G. S., *Hvac&R Res.* **17** (2011) 771–80