3P19

Development of dielectric barrier discharge (DBD) with rotatable electrodes for gas treatment at atmospheric pressure

Sai Ngaunn Hseng[1], N. Rutha Pwa[1], T. Kimura[1], T. Yamaguchi[1], T. Ishijima[1], Y. Tanaka[1], Y. Nakano[1], M. Hata[1], M. Furuuchi[1]
[1]Kanazawa University

1. Introduction

A dielectric barrier discharge (DBD) is widely used in various industrial fields. We have developed a dielectric barrier discharge (DBD) with rotatable electrode to extend its applicability and further applications. To reduce the cost, an ac 60 Hz power supply and a transformer are used. Although low ac frequency is applied and the electrode is consisted to thin metal plates. It is possible to generate DBD along with the inner surface wall due to high speed electrode rotation. In this conference, we will present an applicability for the organic gas decomposition to clean the ambient air.

2. Experiment setup and configuration

Figure 1 show a schematic diagram of the experimental set-up for detecting the concentration of the particle on the filter. In the present study, 40 slm of mixture gas flow rate is introduced to an inertial filter system ANS using a flow meter to fix the rate. Air gas flow rate was fixed at 36 slm and to get the clean air the compressed air was also introduced to a HEPA. The incense's smoke was set at 4 slm and inserted to the reactor which was made from Polyoxymethylene (PMO). Inner diameter, length and the thickness of the reactor were 70, 70, 2 mm, respectively. Aluminum sheets are used as high and ground electrodes and assembled in touch with the wall of the POM. Inside of the POM, a metal electrode plate with three edges is fixed through the bearing and connected to a dc motor. The metal electrode inside the reactor is rotated by the DC motor. We control the rotational speed at 4800 rpm by dc supply. Three valves are mounted to control the flow rate. The applied voltage and the frequency for producing plasma were 30 kV and 60 Hz, respectively. A mixture gas went through the Aerosol dilution system before introduced into the ANS. On the other side, vacuum pump was used to suck the mixture gas from the filter. In order to obtain the concentration of the particle, four layers of filter, which are NS-3 (nano-sampling 3rd layer), NS-4 (nano-sampling 4th layer), IF (initial filter) and BF (backup filter), were mounted in the inertial filter system ANS. To detect the applicable of the plasma for the organic gas decomposition, five different conditions, which shows in table 1, were conducted.

3. Result

Figure 2 shows evaluated the mass calculation at different conditions. From the result we could say that the incense stick was a proper sample to use as a smoke for further investigation. We could also confirm from this experiment about how we could be able to dilute the concentration of the particle on the filter by applying the plasma. By using DBD plasma, the sample characteristic was changed significantly.

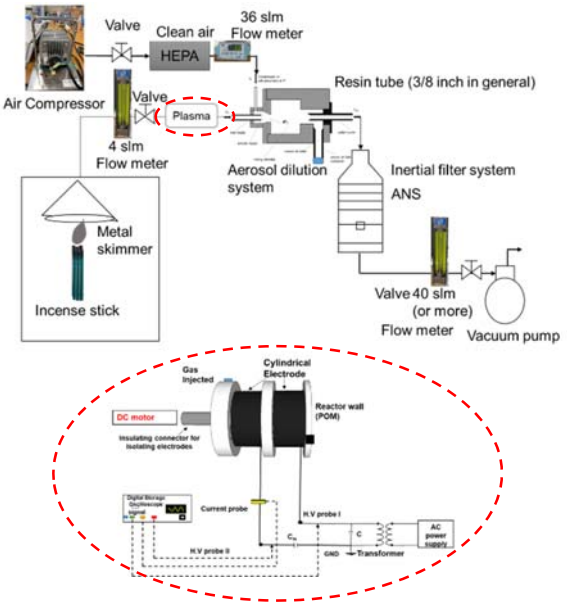
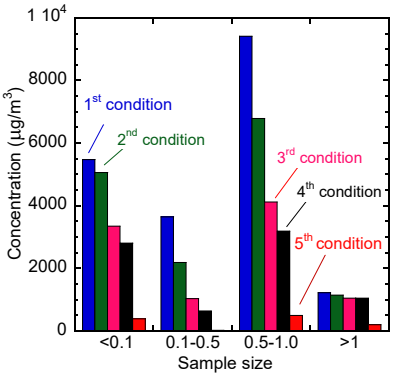


Fig.1 Experiment setup

Tabel 1 Five conditions for smoke particle decomposition

Condition	1st condition	2nd condition	3rd condition	4th condition	5th condition
Reactor	-	O	O	O	O
Rotation	-	-	O	-	O
Plasma	-	-	-	O	O



NS-BF	<0.1
NS-IF	0.1-0.5
NS-4	0.5-1.0
NS-3	1.0-2.5

Figure 2 The mass concentration on the filte