3rdAsia-Pacific Conference on Plasma Physics, 4-8,11.2019, Hefei, China

Fundamental Studies for Electrical Properties of Dielectric Barrier Discharge Plasma with Different Positioning Electrodes at Different Pulsed Voltages

Si Thu Htun[1], Mai Kai Suan Tial[1], Zaw Htet Myint[1], Wunna Swe[1],
Yoshihiko Uesugi[2], Tatsuo Ishijima[2]
[1]Department of Electrical Power Engineering, Mandalay Technological University, Myanmar.
[2]Faculty of Electrical and Computer Engineering, Kanazawa University, Kanazawa, Japan
sithuhtunep@mtu.edu.mm:mkstial@mtu.edu.mm

1. Introduction

In this work, dielectric barrier discharge (DBD) plasma is generated with different positioning electrodes at different pulsed voltages by varying different number of silicon diode for alternating current (SIDACs). The SIDAC is an inexpensive voltage triggered switch with high breakover voltage, V_{BO} and current handling capacities. The characteristics of DBD circuit are controlled by SIDACs switching and switching DBD itself due to choking effect. In this study electrical properties such as discharge voltage, V_{DBD} and current, I_{DBD}, power consumption and mismatching impedances which are effective to DBD plasma are investigated in order to lower the power consumption with generation of efficient ozone for soil treatment.

2. Experimental set up and Results

The experimental set up for DBD plasma in air is as shown in Fig. 1. Two alumina plates with a dimension of (15x15) cm^2 is used as barriers between two or more electrodes which is copper tape (10x10 cm^2). The power source, 10kV, 12 kHz is supplied to a series of SIDACs, Model No. K1V38(W), its V_{BO}= 360~400 V to obtain pulse voltage by SIDAC switching. With these series connecting SIDACs, high voltage pulses in applied voltage occur and then give the DBD plasma which is load [1]. With the same power source and with 5, 10, 15 SIDACs/ without SIDACs , the experiments have been done with the different positioning of electrodes as electrical parameters of DBD plasma with/without a series of SIDACs at different positioning of electrodes are

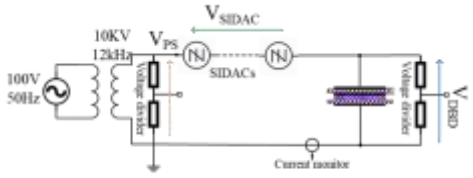

Fig 1. Experimental set up for DBD plasma in air

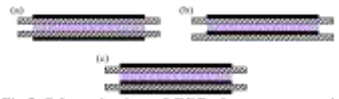

Fig 2. Schematic view of DBD plasma reactors with different positioning electrodes

observed. The emission intensity of plasma is detected by mounted silicon photodiode and also by optic ocean spectrometer. Finally, ozone concentration is measured by ozone sensor. Without SIDACs, the discharge occurs slightly and with SIDACs, it occurs sharply. Generally, increasing a series of SIDACs makes the intensity of plasma higher. The electrical properties changes are effected by different pulsed voltages and electrode positions. These changes reduce or increase the ozone concentration rate because of mismatching impedance between the load and the supply. It was found that different electrode positions could reduce the mismatching impedance.

References:

[1] Y Sumiishi, Y Uesugi, Y Tanaka and T Ishjima, “Enhancement of Non-Equilibrium Atmosphere Pressure He Plasma Discharges by Using Silicon Diode for Alternating Current”, J. Phys: Conf. Series, Vol. 441, Iss. 1, ID.012018, June 2013.