STUDY ON ROLE OF TEMPESTUOUS ADVANCES IN COMPUTER TECHNOLOGY

HITESH KUMAR

DR. RAKESH KUMAR

Director, K.S. Jain Engineering, College, Modi Nagar, U.P.

Reseach Scholar, CMJ University, Shillong, Meghalaya

INTRODUCTION

The first major attempt on excimer formation utilizing the DBD technology was made by Kogelschatz and his coworkers in 1988 [Eliasson and Kogelschatz, 1988; Eliasson *et al.*, 1988; Kogelschatz, 1990; Gellert and Kogelschatz, 1991; Kogelschatz, 1992]. They realized that the excimer known from electron beam experiment can also be formed in silent discharges, if at least one of the electrodes is made transparent to the excimer formation. It was shown that a large number of different excimers can be generated in a simple gas discharge with a DBD. The effect of geometry, different gas mixtures on excimer formation, possibility of obtaining different wavelengths, physical parameters of micro discharge and reaction kinetics of excimer formation in DBD have also been investigated. It is possible to excite excimer radiation in VUV/UV or even in the visible range. Spectroscopic investigations were performed with these sources. Considering the large number of known excimers, one is led to believe that an efficient radiation source for any desired spectral range can be developed. Model calculations describing electrical breakdown and micro discharge formation were also presented [Eliasson and Kogelschatz, 1991; Eliasson and Kogelschatz,1994].

The term excimer (excited dimmer) [Stevens and Hutton, 1960] was initially proposed by Stevens and Hutton in 1960. The acronym excimer was basically applied to the unstable molecular complexes formed from an atom in the ground state and another one in an electronically excited state. Although Basov and coworkers first demonstrated an excimer laser [Basov *et al.*, 1970] and later, several workers [Rhodes, 1974; Rhodes, 1979; Lakoba and Yakovlenko, 1980; Smirnov, 1983] carried out investigations on the properties of an excimer molecule on a large scale. But, it was Tanka [Tanka, 1955] who first demonstrated that rare gas excimer can be formed in electrical gas discharge excited by fast pulses,

microwaves or silent discharge. The second excimer continua of rare gas had also been obtained by Tanka in a much simpler configuration used as spectroscopic light source for absorption measurement in vacuum ultraviolet spectral range. These devices could be regarded as the first excimer UV optical sources, although they were not sealed at that time. Further work on spectroscopic light sources using rare gas excimer emission was continued by Soviet researchers [Volkova *et al.*, 1984]. Investigations were extended to obtain excimer emission from rare gas halides [Shevera *et al.*, 1980] and mercury halides [Malinin *et al.*, 1980]. In all these early investigations, the radiation was extracted through relatively small windows in the dischargevessels.

Review of literature For several years, atmospheric non-thermal plasmas have been studied by various research groups in context with their applications of excimer synthesis in working media of rare gas and their halides. Besides the use of DBD technology for excimer formation, in the beginning of 21stcentury, VUV/UV source based on excimer formation pumped by micro hollow cathodes discharge [Kurnczi *et al.*, 1999; Kurnczi and Becker, 2000] were investigated. Schoenbach and his coworkers investigated MHCD technology for excimer synthesis and efforts were made towards the parallel operation of MHCD discharge and their fabrication in semiconductor [Schoenbach *et al.*, 1997; Habachi and Schoenbach, 1997; Schoenbach and Stark, 1998; Becker *et al.*, 2006]. A special emphasis was laid on spectroscopic studies of plasmas used as a source of noncoherent vacuum ultraviolet radiation such as rare excimer emission, and atomic and molecular emission from plasmas in admixture of rare gases and molecular gases.

Barrientos *et al.* [2006] carried out analysis and electrical modeling of cylindrical DBD reactor configuration at different operating frequencies to achieve better performance by exciting DBD during active phase of micro discharge. Moreover, in electrical equivalent model, they considered the gas gap capacitance as a variable capacitor in the model to represent the gap dynamic behavior due to changeable ionization of gas inside the reactor.

Parousis *et al.* [2006] conducted electrical comparative study of two atmospheric coaxial DBD reactors operating at high gas flow, conceived for surface treatment applications. Both the reactor was driven by a power generator delivering quasi-sinusoidal waveforms in 100-160 kHz. The influence of gas flow value and of the input power on the electrical operation of these systems was also investigated.

Material and method

Since $n = n_0 \exp(\alpha d)$, the number of electrons produced by a single electronis$e_{\alpha d}$. On an average,each primary electron generated near the cathode produces $(e^{\alpha d} - 1)$ positive ions. All these $(e^{\alpha d} - 1)$ positive ions produced in the gap per electron move towards the cathode and impinge on it. If $\gamma$is the number of electrons that are released from the cathode due to the incidence of a single positive ion, the number of electrons generated is $\gamma(e^{\alpha d} - 1)$, where $\gamma$is the secondary electron emission coefficient, defined as the probability of secondary electron generation on the cathode by ion impact. So, in the steady state the total current will be:

$$\frac{I}{I_o} = \frac{e^{\alpha d}}{[1-\gamma(e^{\alpha d}-1)]} \quad (1.1)$$

The number of ionizing collisions over a unit path length is given as:

$$\alpha = \frac{1}{\lambda} e^{-\lambda \frac{l}{}} \quad (1.2)$$

The energy gained by an electron in traversing a distance l must be equal to ionization energy of the gas. Hence,

$$elE = eV$$

$$\text{or } l = \frac{V}{E} \quad (1.3)$$

Substituting l from (3.4) into (3.3)

$$\alpha = \frac{1}{\lambda} e^{-E\lambda \frac{V}{}}$$

But, $\lambda$is inversely proportional to the pressure at constant temperature. Therefore,

$$\frac{\alpha}{p} = A_1 \exp(-\frac{B_1 p}{E})$$

$$\alpha = A\, p_1 \exp(-\frac{B_1 p}{E}) \quad (1.4)$$

The constant A_1 and B_1 are the properties of gases that have been found to be relatively constant for a given gas over a range of field and pressure.

Conclusion;

Cold plasmas can be produced by a variety of electrical discharges such as the low pressure glow discharges or at atmospheric pressure by corona discharges, dielectric barrier discharges, micro hollow cathode discharges, atmospheric pressure plasma jet, one atmospheric uniform glow discharges, plasma needle, rf and microwave discharge, and gliding arc discharge. All these cold plasma generation schemes have different structures, power supply, working conditions and show variable suitability and applicability in several diverse areas. All the cold plasma generation schemes are not suited for surface treatment in the textile and biomedical engineering. A brief description of the non-thermal plasma generation schemes which are most suited in textile surface processing has been providedhere.

There are several constraints for a technique to be preferred over the other in surface modification. The process parameters, appropriate choice of gas, operating conditions along with plasma parameters decide the suitability of an atmospheric cold plasma source for a particular application. Cold plasma sources used in surface treatment must have a sufficiently high electron number density to provide a useful flux of active species but not so high or energetic as to damage the material treated. These constraints rule out dark discharges other than coronas for most applications because of their low production rate of active species; and arc or torch plasma which have power densities and active species flux intensities high enough to damage the exposed material. Glow discharge plasmas whether operated at 1 atm or under vacuum, possess the appropriate density and active species flux for nearly all plasma surface treatment applications.

Limitations

Low pressure glow discharge plasma is sustained between two electrodes extending into a nearly evacuated glass tube. It is produced at reduced pressure and assures the highest possible uniformity of any plasma treatment. The ignition is brought about by a small fraction of charged particles always present in the gas. Accelerated by the applied voltage, their subsequent collision processes cause an avalanche-like increase in the number of charge carriers. If the discharge current generated by this avalanche effect in a glow discharge is increased by applying even higher voltages to the electrodes, different types of discharges and plasmas can be obtained, depending on the applied voltage and current.

Glow discharge plasmas [Liston, 1989; Roth, 1995; Zuchairah, 1997; John, 2005] are of great interest in fundamental research such as in the microelectronic industry and material technology but have only limited applicability in the textile sector. Although with glow discharges, it is possible in a well controlled

and reproducible way to clean, activate, etch or otherwise modify the surfaces of plastic, metal or ceramic materials to improve their bonding capabilities or to acquire totally new surface properties; still the glow discharge plasmas have not yet been able to get a foothold in the textile processing sector because of their fundamental incompatibility and several serious drawbacks.

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