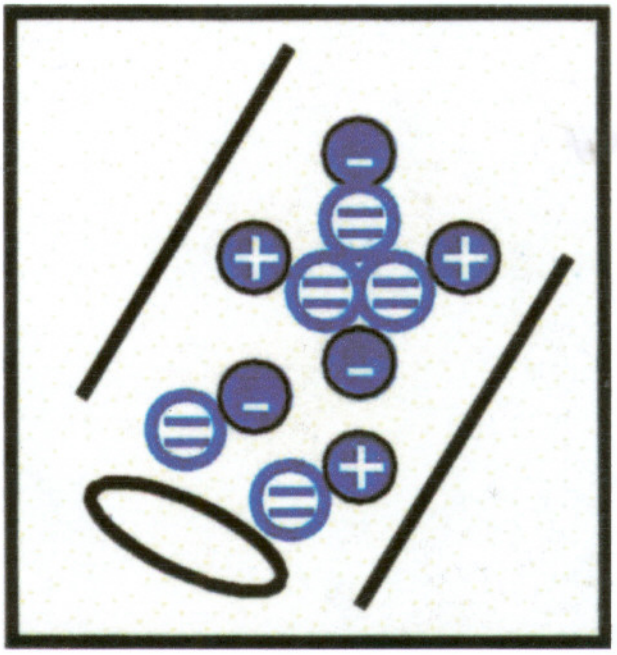
Frontiers in Low Temperature Plasma Diagnostics 8



19th - 23th April 2009
Blansko, Czech Republic

Book of abstracts

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Contact:
e-mail: fltpd8@physics.muni.cz
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Diagnostic of low-temperature air plasma at atmospheric pressure by electrical characteristics

P. Dineff[1], D. Gospodinova[2]

1 Technical University - Sofia (Bulgaria) E-mail: dineff_pd@abv.bg
2 Technical University - Sofia (Bulgaria) E-mail: dilianang@abv.bg

The present work investigates theoretically and experimentally the electrical characteristics of the technological barrier discharge. The electrical characteristics of this discharge are studied on the basis of its experimentally measured external static volt-ampere characteristic.

1. Introduction

Low temperature plasmas have had a very broad range of applications ever since their discovery. The technological electrical barrier discharge at normal atmospheric pressure is applied ever more into the practice of plasma-chemical technologies.

The determination of the basic electric discharge characteristic is substantiated: average value of the electric current as a function of the voltage.

The experimental investigations have been realized under no-load conditions of the plasma technological system, i. e. without taking into account the influence of the treated material upon the electrical characteristics of the discharge.

The technological electric barrier discharge at a normal atmospheric pressure finds application into the practice of plasma-chemical technologies as a successful alternative to the electric glow and RF discharges in vacuum. The elimination of the expensive and difficult-to-operate vacuum system is one of the great ad-vantages of the barrier discharge.

At low active power the barrier discharge produces technological cold plasma containing ozone and chemically active products from its destruction. At high value of the active power the nitrogen oxides prevail and induce another character to the plasma-chemical process. This requires searching for a more reliable control of this process by using electrical characteristics of the barrier discharge.

The great number of ionization and chemical processes going on simultaneously during burning of barrier discharge creates certain difficulties not only for the description of this discharge, but also with respect to its control and diagnostics.

The experimental investigations [1] conducted for a continuous time period allow searching for a new integral description and control of the barrier discharge through its external characteristic expressing the relationship between the average value of the electrical current passing through the discharge and the effective value of applied voltage, Fig. 1.

2. Experimental investigations

The experimental investigation is carried out by varying: the non-uniformity of the electric field, the gauge of the glass barrier, and the size of the working air gap of plasma generator.

The *TASK* of the present work consists in examining the behaviour and diagnostic at no load, i. e. without any material to be treated in the air gap, of low-frequency (50 Hz) barrier discharge burning in air at atmospheric pressure.

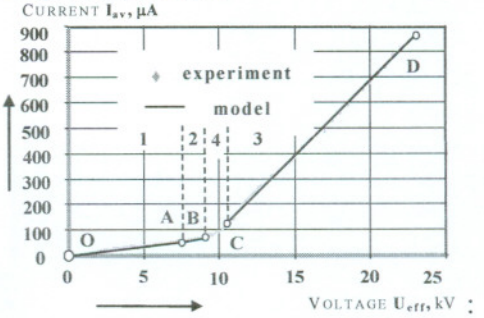

Fig. 1. – *Relationship between the average value of current I_{av} and the effective value of applied voltage U_{eff}: OA - non-operating sector; AB – first operating sector (a cold plasma containing ozone and products of its decomposition); CD - second operating sector (a cold plasma containing nitrogen oxides); BC – transient area.*

The average value of the electric current density can per-form the role of an intensive parameter of the process of discharge burning, because it does not reflect the threshold character of the process of discharge ignition and the transition to each of the two working parts of the external characteristic.

References

[1] P. Dineff, D. Gospodinova. The surface density of the power as a basic parameter of the plasma-chemical modification of the materials in a barrier electrical discharge, International conference ELMA' 02, September 13-14, 2002, Sofia, Bulgaria, Proceedings, pp. 304-310

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