MICRODISCHARGE DYNAMICS OF DIELECTRIC BARRIER DISCHARGE UNDER CONVECTIVE GAS FLOW

Ashirbek A.I.,[*1,3] ***Ussenov Ye.A.,***[1,3,5] ***Dosbolayev M.K.,***[2] ***Gabdullin M.T.,***[4] ***Ramazanov T.S.***[1,2]

[1]*NNLOT, KazNU, Almaty, Kazakhstan,* [2]*KPS, Almaty, Kazakhstan,* [3]*IASIT, Almaty, Kazakhstan,* [4]*KBTU, Almaty, Kazakhstan,* [5]*MAE, Princeton, NJ, United States*

**azamatjan97@gmail.com*

Dielectric barrier discharge (DBD) at room conditions, when air is used as the plasma- forming gas, typically exists as randomly distributed thin microdischarge (MD) channels. These channels exhibit complex collective phenomena and give rise to a variety of self-organized patterns. Understanding the collective interaction and dynamics of MD channels is important not only for static bulk DBDs in air, but also for DBDs under the influence of external factors such as gas flow. In addition, the introduction of additional gas flow can be considered as the simplest and most economical method to achieve uniform diffuse DBD in air, which is very relevant for various technological applications.

While the behavior of bulk DBD in an external gas flow has been studied in some detail, to date there is little data on the effect of natural convective gas flow on the collective behavior of MD channels and the structure of filamentary barrier discharge in air.

This paper presents a study of the optical and electrical characteristics of dielectric barrier discharge (DBD) with microdischarge channels. The study focuses on the dynamic properties of filaments in a dielectric barrier discharge under convective airflow conditions, building on our previous studies [1, 2]. Various discharge parameters, including average microdischarge and gas flow velocities, as well as discharge and dielectric layer temperatures, were systematically measured. High-speed discharge imaging and Particle Image Velocimetry (PIV) analysis provided additional insight into the filament motion, which made it possible to measure the average velocity at certain dielectric layer temperatures. Convective flow in the interelectrode volume was modeled using COMSOL Multiphysics.

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2. Usenov E. A. et al. // Plasma Physics Reports. 2020. V. 46. No. 4. P. 459-464.