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PIV VISUALIZATION OF FLOW PATTERN INDUCED BY DIELECTRIC BARRIER DISCHARGE

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In this experimental work the airflow, induced by asymmetrical dielectric barrier discharge (DBD) [1], was investigated. The peculiarity of the asymmetrical DBD is the presence of huge gradient of electrical potential in area, where the ionization of air, discharge and glow of plasma occur. Along the surface of discharger the airflow appears, and it induces the vortex near the discharger initiation area. The velocity magnitude of air jet induced by DBD is sufficient enough to affect on flow pattern around the body placed in the subsonic airflow [2].

The visualization of airflow and vortex was performed by optical methods - high speed schlieren and 2D planar particle image velocimetry (PIV). The power supplying to discharger was provided by high voltage AC/AC-converter with variable amplitude of output voltage 0-5 kV and with the frequency 60 kHz. The investigation was carried out in two stages. At first the investigation of steady near-wall airflow was performed after the several seconds after discharge initiation. The instantaneous distribution of velocity in the near-wall airflow was obtained with the spatial resolution 0.1 mm. Then the high speed visualization and velocity distribution measurement were carried out in the airflow during 0-10 ms afterdis charge initiation with the spatial resolution 0.1 mm and time step 0.1 ms. The evolution of vortex structure was obtained with the different amplitude of voltage, applied to discharger.

The comparing of two visualization techniques was carried out. The parameters of airflow development depending on the amplitudes of voltage, applied to discharger, were obtained. It was found, that flow pattern induced by DBD consists of two vortexes, the main and secondary. Though the dimensions and velocity value are different in their cores, the values of Z-component of vorticity are equal but opposite in direction.

1. *Pietsch G.* Peculiarities of Dielectric Barrier Discharges // Contrib. Plasma Phys. – 2001. – V.41, N. 6 – P. 620−628.

2. *Moreau E.* Airflow control by non-thermal plasma actuators // J. Phys. D: Appl. Phys. – 2007. – V. 40, N. 3. – P. 605-636