DEPENDENCE OF IGNITION AND COnstriction voltage OF SURFACE BARRIER DISCHARGE FROM PRESSURE AND MATERIAL OF CORona ELECTRODE

1,2Selivonin I., 1Moralev I., 3Shcherbanev S., 3Alicherif M., 3Starikovskaya S.

1Joint institute of high temperature RAS, 125412 Moscow, Izhorskaya st., 13/2,  
 [inock691@ya.ru](mailto:inock691@ya.ru)  
2National research university «MPEI» 111250, Moscow, Krasnokazarmennaya st., 14  
3Ecole polytechnique, 91128 France, Paris, Route de Saclay

The dependence of the ignition voltage and the burning mode of a surface dielectric discharge on the pressure of dry air in the range 0.2-4 bar was studied. The discharge was investigated for a surface configuration with a circular corona electrode. Copper and alumina electrodes were used, as well as electrodes made from the same materials exposed in the discharge. Discharge was supplied by a sinusoidal voltage with an amplitude of up to 8 kV and a frequency of 100 kHz and by nanosecond pulses with an amplitude of up to 30 kV. The discharge was ignited in a mixture of N2-O2 (synthetic air).

In the experiment, the oscillograms of the supply voltage and the transferred charge were recorded, the discharge images were taken on the CCD and ICCD cameras.

The moment of ignition of the discharge was determined by the presence of a charge transported to the surface of the barrier and by the luminosity of the discharge gap in the visible part of the spectrum. The onset of contraction was determined from the point of inflection of the P (U) dependence, and from the appearance of longer and bright channels on the background of the streamer-diffuse discharge form.

In the case of a sinusoidal DBD, the magnitude of the threshold values of the ignition voltage and the contraction depends as pressure to the power of 0.4 (Fig. 1). In this case, the nature of the dependences obtained for electrodes of different types is practically the same. It is shown that the electrode material has some effect on the of the constrict voltage. It is shown that in the case of using copper electrodes, the discharge power is higher than in the case of using aluminum electrodes, and the contraction occurs earlier.

It is shown that in a discharge triggered by single voltage pulses of 30 ns duration and amplitude at a high voltage electrode from 15 to 40 kV, a transition from a streamer-shaped discharge to a contracted filamentary form is also observed. The transition occurs within 1-2 nanoseconds at the leading edge or on the voltage pulse plateau. Qualitatively, the transition pattern is similar for electrodes made of copper, aluminum, annealed copper, and annealed aluminum. With increasing pressure, the transition voltage decreases. On electrodes from annealed metals, the transition occurs at a slightly higher voltage or higher pressure.

This work was carried out within the framework of cooperation in the international laboratory LIA "Kinetics and Physics of pulsed plasmas and their afterglow" and with the support of the RFBR grant 17-58-16004