ULTRAVIOLET RADIATION OF THE SURFACE DISCHARGE IS A PREIONIZER OF HIGH PRESSURE ATOMIC-MOLECULAR IMPURITIES

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The results are concerned with the experimental investigation of preionized radiation of the surface discharges propagating over the substances with different values of dielectric permeability onto atomic-molecular high pressure gas impurities.

The interest to the surface discharges results from their following properties:high optical output, high power and considerable discharge aperture, comparatively ordinary bright temperature control. A specific character of the discharge interval breakdown due to strong gradients to the electric field on an interface of dielectric gas allows to make an agreement between discharge interval and accumulation without difficulties. As a result, the energy contribution rate rapidly increases and, as in consequence, a discharge plasma by their radiative properties becomes close to a black body with a surface temperature 50000°K.

It is shown that, as an ultraviolet preionization source of the atomic-molecular gas impurities it is appropriate to use over the substances the discharges with a high value / 10^3/ of dielectric permeability, say,ceramics. In this case, an efficiency of the surface discharge, as a preionizer of gas impurity, which creates a great number of photoelectrons is much better than another optical sources, say, the open sparks. A compositions and pressure variations of the surrounding gas make it possible to control effectively a spectral composition and surface discharge radiation character that opens an optimal possibility (i.e. having minimum expenditure of energy) for gas medium photoionization or for photoinitiation of gas reactions. The former opens the good chances for investigations of different microscopic processes such as recombination, energy exchange between different components of gas impurities where it is easy to develop a nonequilibrium thermodynamic passing a current through a photoionized gas.

In the process of investigation of plasma discharge optical radiation the new, unknown previously, features of the light pulse behaviour were observed over the ceramics surface. A selfdamage of the overtensed surface interval favoured the short-closed line creation filled by a

dielectric with a high value of dielectric permeability. The nonlinear line loses caused by dependence of plasma filament resistence of the discharge current, under suitable conditions promoted a formation of short electromagnetic wave with the front irradiation a short / 30nsec/ pulse of hard ultraviolet radiation. On the time scale this pulse is followed by a discharge arc stage in the developing of which one realizes a main energy contribution into a discharge and the optical discharge radiation pulse is shaped with a duration on the order of magnitude exceeding an ultraviolet glow of the shock electromagnetic wave front.

As a result of the combined effect of the shock wave front radiation and that of the arc stage of a discharge the characteristic values of photoelectron density in different gas impurities were 10^{8}-$10^{12}cm^{-3}$. The energy in preionizer was 6-8j.

Photoelectrons were registered by a probe-Faradey cylinder whose constructive features made it possible to investigate a space photoelectron distribution basing of which one can conclude on a mechanism of photoionized process. As, for example, in molecular impurities CO_2:N_2:He of different partial composition, a propagation of 1700Å ultraviolet radiation which are controlled by CO_2 molecules, the photoelectrons arranged in 2-6cm out of preionization sources were conducted in consequence of two-step excitation process, when two light quanta molecule absorption results in photoelectron developing.

A distinctive feature of the surface discharge operation as a preionizer compared, for example, to the open sparks is, that at gas pressure over 500 torr the photoelectron density in some gases /He, N_2/ is independent of pressure while in case of the open sparks the photoelectron concentration falls rapidly with gas pressure growth.

This specific peculiarity results from increasing of optical output of the surface discharge, the more the pressure of surrounding gas. Due to this fact, for high pressure impurity ionization it is more appropriate to use the surface discharges.

A designed qualitative model of the process investigated explaines the obtained experimental results on the base of which a possible photoionization ultraviolet pumping by a discharge surface radiation of rapidly recombined atomic hydrogen plasma is discussed.