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PARTIAL DISCHARGE EMISSION CHARACTERISTICS IN THE UV RANGE

Y.A. YAKOVLEV[1], N.B. KALYASKAROV[1], N.R. ZHOLMAGAMBETOV[1], L.A. ZINOVYEV[2], U.B. ARKABAEV[1], I.R. GALIMYANOV[1]
[1]Karaganda technical university, Karaganda, Kazakhstan
[2]Karaganda Buketov university, Karaganda, Kazakhstan

This work is a continuation of the research described in [1].

The dependence of the energy characteristics of partial discharge radiation in the UV range on the discharge conditions was studied.

The plasmatron, in which the discharge was carried out, was powered from a pulsed RC generator, the scheme of which is also given in [1]. A plug spark without a top electrode was used as a plasmatron, diameter of the central electrode 2 mm, value of the discharge gap δ = 3 mm. The space 10 mm deep between the central electrode and the outer electrode was filled with 1.5% NaCl solution. During the experiments, the polarity of the central electrode (CE) was changed. To register UV radiation, we used a combined instrument "TKA-PKM" series designed to measure the energy illuminance (E, mW/m^2) in three spectral regions: 200...280 nm (UV-C zone), 280...315 nm (UV-B zone) and 315...400 nm (UV-A zone). The instrument also displays the calculated parameters: the maximum (peak) value of energy illuminance E_{max} and energy exposure in the corresponding spectral regions. Switching from one part of the spectrum to another is done by changing the receiving optical heads. Since the duration of discharge is 10^{-3} s, and the time constant of the device is equal to 1 s, to get the real values of illumination, we recalculated the readings of the device by the formula, $E_{(calc)}=(t_2/t_1)E_{(meas)}$, where t_2 is the double time constant (the reaction time to flash appearance and to its extinction was considered), t_1 is the time of the discharge existence [1]. Since the measuring heads have a limited angle of view (10°), they were located at such a distance (0.09 m), that the radiating region completely falls into this angle.

Measurements of the energy illuminance were performed for discharges occurring at different values of the voltage U, applied to the discharge gap. The polarity of the applied voltage was also changed. As the value of the applied voltage increased, the type of discharge changed. An incomplete partial discharge turned into a completed discharge, which was accompanied by a bright flash. In the course of the experiments, no UV radiation was detected in the course of an incomplete partial discharge, most likely due to its low intensity. Also UV radiation in the region of 200-280 nm was not registered due to its absorption by the atmosphere.

The data obtained during the experiments are shown in Table 1

Table 1 - Peak values of energy illumination in the UV range during a completed partial discharge

Polarity of the CE	Spectral region, nm	U, V	$E_{max(meas)}$, mW/m^2	$E_{max(calc)}$, mW/m^2
minus	315-400	675	5,56	11120
minus	280-315	675	9,18	18360
plus	315-400	630	8,36	16720
plus	315-400	900	6,06	12120
plus	280-315	600	29,5	59000
plus	280-315	900	23,3	46600

As you can see the UV radiation is mainly concentrated in the 280-315 nm range

REFERENCES

[1] E A Yakovlev et al 2021 J. Phys.: Conf. Ser. 2064 012038