At present the sources of UV and VUV spontaneous radiation are vigorously investigated and enjoy wide use in different areas of science and technology. However, the devices developed to date and manufactured by the industry do not satisfy all requirements. For instance, to calibrate spectral instruments and optical elements requires point UV and VUV radiation sources with a radiating volume of ~1 mm$^3$ and a relatively high pulsed output power (above 1 W). Also of practical interest are the sources with nanosecond pulse duration operating in a pulse-periodic regime.

The aim of our work is to study the optical characteristics of a nanosecond high-voltage discharge with electrodes of small radius of curvature and to make a point short-pulse UV radiation source with a radiating plasma volume of less than 1 mm$^3$ operating in a pulse-periodic regime.

In our experiments use was made of an FPG-10 generator with voltage pulse amplitude up to 12.5 kV in the transmission line. In the case of operation with a matched load, a longer half-amplitude voltage pulse duration for a rise time of ~0.2 ns at a 0.1–0.9 level. The generator was connected to the discharge gap via a 50-W cable of length 1.3 m. The discharge was formed in the atmospheric pressure air between the two electrodes terminating in cusps with small radii of curvature. They were made of stainless steel, aluminum, copper, titanium, tantalum, and tungsten. We have investigated the emission of discharge plasma in the breakdown of narrow interelectrode gaps (0.5, 1, and 2 mm). It was discovered that the breakdown of an atmospheric-pressure air gap $d = 0.5$ mm with a strongly nonuniform electric field is accompanied with the production of runaway electrons in the initial stage of discharge. This manifests itself in the emission of X-ray radiation from the discharge gap and the consequential preionisation of the discharge gap by the runaway electrons and the X-rays, as well as in the existence of diffusive discharge stage. As shown in our work, in the breakdown by voltage pulses with an amplitude of ~10 keV at a repetition frequency of 1 kHz under these conditions (0.5 mm) the main contribution to the plasma emission is made by continuum emission and the lines of electrode material, about ~40% of the total radiation energy being concentrated in the 200–300 nm range. We plan to use these discharge regimes for producing point UV radiation sources with the emission spectrum varied in different parts by employing various electrode materials.

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