PHYSICAL INSTRUMENTS FOR ECOLOGY, MEDICINE, AND BIOLOGY

A Multichannel Discharge UV Source

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Abstract—A source with a spark discharge at the atmospheric gas pressure is described. A multichannel version of the spark discharge from a single generator with the use of an inductive current divider is realized. The number of the discharge channels and geometry of their disposition can vary over a wide range, depending on the problems being solved.

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The bactericidal action of UV radiation is widely used in medicine, biology, and in technological processes. Therefore, an interest in creating more perfect UV radiation sources remains stable. A great amount of attention has been paid lately to designing and creating open plasma sources, which possess a number of advantages over traditional mercury-vapor tube sources [1]. The described discharge source belongs to this class of sources.

The spark discharge in the air, which is famous for its efficiency of UV radiation generation, is used in the source [2]. The discharge is powered by a generator producing high-voltage pulses with steep leading edges [3], which was designed earlier as a power supply for lasers. When a spark is initiated, it produces current pulses with a ~ 10 -ns rise time, ~ 100 ns duration, and pulse repetition rate of up to ~ 10 kHz. In this case, the current amplitude is limited from above by ~ 150 A. Therefore, this discharge can be called “a spark with a limited current.”

To create a wide-aperture emitter, it is necessary to have a multichannel version of the spark discharge powered from a single generator. As a rule, this is a rather complex problem when the discharge occurs at the atmospheric gas pressure. However, it was revealed in the course of the performed experiments that the used generator successfully operates in the multichannel version if the inductive current divider is used. A trial 10-channel linear version of the spark discharge was produced. In it, one electrode is one-piece, and the second electrode consists of flat end walls of ten tightly packed in line copper wires in a 1-mm-diameter enamel insulation, and the spark gap is ~ 1 mm.

The figure shows a photograph of the discharge gap upon initiation of a spark discharge with a ~ 4 -kHz frequency. The measurements performed in various spec-

trum regions have shown that $\sim 70\%$ of the radiation energy lies below 400 nm; in this case, $\sim 35\%$ of the energy is emitted in a region of $\lesssim 250$ nm. The power of the emitter is easily regulated by selecting the discharge pulse repetition rate. The design parameters of the radiator, such as the number of discharge channels and their arrangement, can vary over a wide range in accordance with expected tasks.

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