Numerical STUDY OF FAST IONIZATION WAVES IN EXTENDED CAPILLARIES NON-UNIFORMLY FILLED WITH GAS [[1]](#footnote-1)\*)

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Gas breakdown in extended shielded dielectric tubes under the action of voltage pulses takes the form of an ionization wave, characterized by the formation of a localized front with a high electric field strength, which propagates from the powered electrode to the grounded one. The front propagation velocity depends on the voltage rise rate, and can reach values of the order of 109 cm/s [1]. A consistent description of ionization waves can be carried out using a one-dimensional analytical model, which provides self-similar solutions that describe the wave structure far from the electrodes [2]. Modern methods of numerical simulation of low-temperature plasma and breakdown processes can significantly expand the possibilities of theoretical analysis of ionization waves, take into account the two-dimensional nature of their propagation and the variety of associated elementary processes [3,4].

In the present work, a theoretical analysis of ionization wave propagation in the presence of a longitudinal gas density gradient in the dielectric tube (or capillary) was carried out. Interest in this formulation of the problem is connected with studies of soft X-ray sources based on nanosecond capillary discharges, in which such a gradient is created to reduce the fraction of radiation absorbed in its own gas [5, 6]. The results of a parametric analysis of the influence of the density gradient on the ionization wave dynamics and the properties of the plasma formed at the propagation stage and after the closure of the interelectrode gap are presented. The applicability of the one-dimensional radial model for describing the parameters of plasma and gas dynamics at moderate amplitudes of the discharge current is discussed.

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/Lt/ru/EQ-Eliseev.docx) [↑](#footnote-ref-1)