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Numerical simulation and stability analysis of a spark discharge high-voltage switch. VASILY KOZHEVNIKOV, Institute of High Current Electronics, VLADISLAV IGUMNOV, Tomsk Polytechnic University, ANDREY KOZYREV, ALEKSANDR KOKOVIN, ANDREY ZHERLITSYN, EVGENIY KUMPYAK, Institute of High Current Electronics — In this work, we propose the numerical theoretical model for the simulation and stability analysis of a spark-gap high-voltage switch. These devices are of particular interest as commutators of high energy in facilities intended for technological applications, mainly high-current RC-generators. For such switches, a stability problem of voltage triggering is critical. We propose an accurate theoretical model of the high-voltage high-current switch based on the drift-diffusion theory of a multicomponent discharge plasma in the atmospheric-pressure air. The simplified plasma kinetic scheme with the reduced number of components (namely, N_2^+, O_2^+, N_4^+, O_4^+, $O_2^+N_2$, O_2) is implemented to model air discharge atmosphere. In order to investigate the stability of triggering depending on initial conditions profile first, we perform one-dimensional simplified simulation, and then the realistic two-dimensional axisymmetric model of the spark gap is studied. Within the framework of this model, the electrophysical parameters of the spark gap are calculated, which are in agreement with the available experimental observations. The developing of the proposed model opens possibility to investigate the triggering stability depending on the initial preionization profile of the gas-discharge gap.

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