Simulation of cathode spot formation in arc discharges

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The paper is presented a self-consistent model describing the dynamics of the ignition arc and the dynamics of the formation of the cathode current spots. The model is based on a self-consistent description of the processes occurring at the electrodes and in the discharge gap. To describe the behavior of charged and excited particles used fluid approximation, self-consistent field in the plasma and the potential profile in the space charge layers are determined from the Poisson equation. Description of the processes occurring with participation of electrons is based on the solution of the Boltzmann equation. Furthermore, the system of equations includes the energy balance equation of the electrons and heavy particles. To describe the processes occurring at the cathode, formulated heat balance equation for the cathode and differential Ohm's law. At the boundary between the plasma and the cathode were considered conjugate effects: heat flux from the plasma to the cathode, bombardment by charged particles, thermal emission of electrons from the cathode, and others. On the basis of the evolutionary model we performed a series of numerical experiments to study the dynamics of arc ignition, depending on various external factors. The main result of these experiments is to demonstrate the dynamics of the ignition of the arc discharge [1], as well as the temporal evolution of the formation of the current cathode spot. This work was supported by the Russian Foundation for Basic Research (project No. 16-38-60187)

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