The mathematical model of a short arc at the blow-off repulsion of electrical contacts during the transition from metallic phase to gaseous phase

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Abstract: The mathematical model describing the dynamics of temperature field in electrical contacts at the initial stage of a blow-off repulsion is presented. It is based on the Stefan problem for the disk of a short arc and two spherical domains for the liquid and solid zones. All coefficients in the equations such as the thermal and electrical conductivities, density, thermal capacity are dependent on the temperature. The analytical solution of this problem is obtained using the similarity principle. The results of calculation are compared with the data obtained in published papers and with the experimental data.

Mathematical modeling of the electrical arc is very important to understand its dynamics and to estimate arc parameters because experimental methods give as a rule only the resulting information about arcing and arc erosion because of a fleeting process. General models describing phenomena in the arc plasma are based on the systems of partial differential equations of the magneto-hydrodynamics (MHD) [1] - [4].

Keywords: Similarity principle, temperature dependence, metallic phase, gaseous phase, Stefan problem.
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