THE INFLUENCE OF EXTERNAL FLOW ON THE DYNAMIC OF ARC CHANNEL MOVING ALONG THE WALL WITHIN A MAGNETIC FIELD

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A theoretical study of the arc behavior has been conducted. The moving arc in surface magnetic field is used in high-voltage circuit breakers, plasma actuators. In practice, an important role plays the exact position of the discharge relative to the device construction or the heterogeneity of the environment. The arc discharge is moving in the magnetic field under the action of Lorentz force **f** = [**jB**], pressure gradient and, to a certain extent, viscosity forces. The Lorentz force and the viscosity forces cannot be balanced by the pressure gradient, this way a continuous vortex generator is formed within the flow. The influence of the wall on the arc channel trajectory is determined by the remoteness of the arc from the wall and border conditions on the wall. The main parameter analyzed in the experiment was the trajectory of the arc discharge front line, first of all the distance between the wall and the arc center. At the beginning, after the ignition of the arc discharge, there is a shift from the surface of the wall, approximately equal to the arc diameter. When the discharge is moving against the flow, a decrease of indent h is observed, compared to the absence of external flow. The external flow doesn't have considerable influence on the value h. It was shown that the increasing velocity of external flow leads to the intensification of the effect. At the same time, the external flow has influence on the velocity of the arc: the velocity of the arc increases moving along the flow and decreases moving against it. A theoretical calculation of the arc discharge moving in external flow under the action of the Lorentz force was conducted using the package PlasmAero. This package enables us to make a self-concordant solution of Navier-Stokes equations and Maxwell's equations in MHD-approximation for real gases in 2D-non-stationary case [1]. The achieved trajectories of the "hot point" of the discharge are close to the experimental ones. Features of the velocity and pressure distribution in near the arc channel have been detected. It was determined, that the velocity of the "hot point" depends on the conductivity model of the working mass (in this study it was the air), in particular, on the effective relation of conductivity on temperature. It was shown, that the velocity field near the arc channel is formed mainly by a pair of vortexes, and the velocity of the working mass in the "hot point" is approximately two times greater than phase velocity of the "hot point". A further research is needed in order to study the mechanism of the arc's indent from the wall in greater detail.

REFERENCES

1. V.A.Bityurin, A.N.Bocharov, Advanced Mhd Assisted Mixing of Reacting Streams // *AIAA 2001-0793, 39th AIAA Aerospace Sciences Meeting and Exibit*, 8-11 January 2001, Reno, Nevada.