Investigations of Peculiarities of the Plasmoids Formation and Their Dynamics Depending on the Erosive Type Ddischarge Organization

A.S.Pashchina, V.I.Nikolaeva, M.K.Sidorenko, V.A.Prudchenko
Joint Stock Company " Scientific Research Institute of Radio Device Instruments ", 80, Leningradsky prospect, Moscow, Russia, 125178

Experimental researches of the plasmoids formation in a range of the erosive discharge energy 30 J - 22 kJ and the discharge channel diameters 1...4 mm have been carried out.

Possibility of the plasmoid scale parameters magnification by the means of the discharge channel sizes and the charged particles

flow integrated power magnification at maintenance of specific energy parameters optimum values (pulse power density w~5 MW/cm^3, current increase velocity dI/dt~500 kA/s, medial current density per channel cross section - no more than 15 kA/cm^2), is experimentally shown.

Possibility of magnification of the plasmoid energy parameters (quantity of the reserved energy) by the means of stabilization of the capillary type discharge in the near surface field of the discharge channel which are carried out by the forced delivery of gas is experimentally shown.

It is experimentally defined, that the plasmoid time existence regulation (at least, up to 0,5 sec) by the mean of the erosive discharge duration change appears to be possible, apparently, only in a restriction mode of the discharge current (up to 100 A). In a mode when the discharge current exceeds the specified value, an optimum duration of the capillary type discharge, that provide the plasmoid formation with the maximum power parameters and the linear sizes, appears to be limited and closed to a half-cycle value of the discharge circle oscillations at the discharge parameters, closed to optimum values.

It is experimentally established, that the gas flow influence does not inhibit the plasmoid formation in the case, when the gas flow injection near the discharge channel edge vicinity is absent. In these conditions the great number of cases are demonstrated the increase of the plasmoid existence time duration after the discharge termination.

The basic role of influence of the ionic stream configuration, formed on the discharge channel exit, on the process of the plasmoid formation and on the plasmoid performances is revealed. It is shown, that change of the ionic stream spatial configuration by the means of the electric field potential distribution change, of the magnetic field influence, and also of a gas flow influence on the discharge channel edge leads the essential decrease of the plasmoid scale and energy performances up to inhibition of the plasmoids formation.

This work is executed at the support of the Russian Foundation for Basic Research, the project 07-02-12029.