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ELECTRICAL EXPLOSION OF FLAT COPPER CONDUCTORS IN CURRENT SKINNING MODE*

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Experimental studies of the explosion of flat copper conductors on the MIG facility at a current level of 2 MA passing through them and a current pulse rise time of 100 ns have been carried out. In these experiments, we have studied the electric explosion of flat conductors in the current skinning mode, and the propagation of a magnetic field nonlinear diffusion wave that occurs during such explosion. The magnitude of the magnetic field induction significantly exceeded the values required for the explosion of both plate surfaces in a symmetrical configuration. The conductor surface plasma formation was recorded by its glow in the visible range using a four-frame optical camera with an exposure time of 3 ns for each frame. The internal structure of the surface plasma at different times was studied with X-ray radiography with $h\nu > 0.8$ keV and an exposure time of 2-3 ns, which is formed in the X-pinch "hot spot". It has been shown that during the explosion in megagauss magnetic fields of flat conductors, the width of which (along the x-axis) is much greater than their thickness (along the y-axis), and the current flows in the direction of the z-axis, the plasma expansion along the x-axis is suppressed, and the conductor expands along the y-axis almost from the beginning of the current flow through it. In this case, large-scale instabilities develop on the foil edge, the appearance of which is similar to the instabilities that develop during the cylindrical conductors explosion. On the wide side of the plate along its longitudinal axis z, approximately 75 ns from the current beginning, a plasma channel is formed. Estimations, that were made taking into account the enhancement of the magnetic field at the foil edges showed that it takes about 70-80 ns for the propagation of magnetic field nonlinear diffusion wave from the foil edge to its center. Interpretation of the experimental results was carried out using radiation magnetohydrodynamic simulation (RMHD) of the flat conductor's explosion process. The performed magnetohydrodynamic calculations showed good agreement with the results of experiments on measuring the expansion rate along the y-axis from X-ray shadow patterns.

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