INTEGRATED APPROACH TO PROCESSES OCCURRING IN PLASMAFOCUS DISCHARGE RESEARCH

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Over the past few years, the largest plasma-focus facility PF-3 in the Kurchatov Institute has succeeded in creating a unique diagnostic complex for studying the dynamics of plasma flow formed as a result of a plasma-focus discharge. The complex includes electronic-optical recorders, magnetic probes, light collimators and spectroscopic equipment for monitoring the time course of characteristic spectral lines in the optical range ([1-3], etc.). Also, work was done on numerical simulation of the process of formation of the plasma focus using the ideal single-fluid two-dimensional MHD model. Comparison of the simulation with the experimental results obtained by various diagnostic methods allowed the code to be developed to the level that correctly reproduces the scenario of the formation of the PF for different gases (and mixtures) without the need to select and modify the modeling parameters. By means this extensive and versatile tool, it is possible to use a comprehensive approach to studying the formation and dynamics of the propagation of pulsed plasma flows. Data obtained by various diagnostic methods can be used to better interpret the results of each individual diagnosis and also to verify the results of computer modeling. At the same time, mathematical modeling, oriented to obtaining the results of any particular experimental technique, makes it possible to interpret experimental results much better.

At present, interest in plasma-focus facilities is associated with their active use as neutron sources and also the use of plasma flows in technological processes. In recent years, plasma-focus systems have been modeling astrophysical processes, showing the clear advantage of such experimental systems over others (including [4]). Due to the lack of comprehensive information on the features of the formation of axial flows of matter during the compression of the current-carrying shell in the plasma focus, and also the incorrect interpretation of experimental data by other groups of researchers, the work carried out on PF-3 seems extremely relevant. The data we obtained and their interpretation find a good fit with numerical simulation and classical works on the physics of the plasma focus and the propagation of plasma flows and, in our opinion, generalize and unite them, which is important in the formulation of further experiments.

The report describes the diagnostic complex PF-3 and presents results that clearly demonstrate the advantage of the integrated approach to the study compared with the analysis of the results of individual diagnostic techniques.

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