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STUDY OF THE INFLUENCE OF PLASMA CHANNEL CHARACTERISTICS IN THE DIODE GAP OF THE HIGH-CURRENT ELECTRON ACCELERATOR "KALMAR" ON THE FORMATION OF COMPRESSION WAVES IN POLYMER TARGETS *)

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In the modern world, new composite and polymeric materials are created that find application in various fields of science and technology. It is necessary to test these materials for resistance to powerful pulse effects, since the results of these experiments can be applied both to research in the field of fundamental physics and to practical problems under the exposure of powerful pulse dynamic and energy loads.

This work examines shock wave processes in transparent polymer targets under the exposure of a high-current electron beam of the Kalmar accelerator. During the experiments, shadow optical diagnostics was used with the use of electron-optical registration in the chronographic mode.

When analyzing target damage after exposure to a shock wave, most studies focus on the short-term interaction (about 100 ns) of the electron beam with the material. At the same time, the processes occurring in the plasma filling the diode gap are usually not considered, despite the fact that some experimental data [1] give grounds to assume that the parameters of this plasma can significantly affect the shock wave processes in the target.

In this regard, the processes occurring in a cylindrical plasma diode channel were studied within the framework of one-dimensional magnetohydrodynamics. According to the modeling results, it was revealed that a region of increased pressure arises in the plasma column, the value of which can reach 600 MPa. At the same time, the minimum pressure value for a PMMA sample that can be observed experimentally was 8 MPa [2].

Also, to compare the modeling results with the experimental data, the chronograms were processed, which display the expected secondary shock waves. Based on the slope of the shadow and the change in this slope over time on the chronogram, the propagation velocity and the coordinate of the formation of the corresponding shock wave on the target surface were obtained.

It was found that most secondary waves have velocities slightly exceeding the speed of sound in the target, which indicates high pressure generating them. Probably, it was this pressure jump that was recorded during the simulation. Thus, both the experimental data and the numerical simulation confirm the importance of taking into account the processes occurring in the diode plasma, since the pressure achieved in the plasma channel can be sufficient to generate shock waves.

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