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Advanced Materials Science Research

Obtaining supercritical metal fl uids by the electromagnetic implosion of thin cylindrical shells

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Biography

V Antonov is the Head of the Department of Higher Mathematics, St. Petersburg Polytechnic University. His research interests are focused on creating mathematical models of energy processes in complex biological and technical systems. He is a participant and organizer of international conferences (Russia, Italy, Spain, Great Britain, Portugal, etc.).

Abstarct

Statement of the Problem: An important direction of modern research is the substance unique properties in the field of supercritical parameters including the possibility of these states sharp decay. To obtain supercritical fluids, it is necessary to create a high energy density in the substance. It can be achieved when using pulsed energy injection into a substance with maximum peak power. A possible method for creating the required energy density in metals is an electric explosion. It provides a high current density of 108 A/cm2 and a high specific power of Joule heating of a substance. But in this case, the requirements for the electrical circuit power system are extremely high. They can be reduced by using a spatial concentration of power in the substance. This may be the magnetic implosion of cylindrical metal shells on the axis of the certain configuration. The interaction of compressible shell with a cylindrical target located on the axis of the system is also of interest. These methods are applicable to obtain powerful megajoule pulses of soft x-ray radiation and magnetic field pressure of the mega bar range. The energy storage and multi-stage energy switching systems create mega ampere current pulses with a high slew rate. In such a linear system, the kinetic energy of a compressible shell collides with a target and transforms into the energy of a converging cylindrical shock wave. As a result, it becomes possible to exacerbate the radiation pulse and pressure in the shock wave. The calculation analysis of the process is based on the one-dimensional two-temperature magneto hydrodynamic radiation model, in which the physical processes are self consistent. We formulate the requirements for a laboratory energy source to establish the characteristics of a current pulse fl owing through a conductive cylindrical shell and its dimensions.

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