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Intense shock waves for extreme states of matter generation

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The behavior of matter at extremely high temperatures and pressures is of high principal interest for understanding the structure and evolution of astrophysical objects, giant-planets and many energy, nuclear and chemical technologies. Dynamics methods of generation of high local concentration of energy in condensed matter, based on the compression and nonreversible heating of matter in intensive shock waves and aligned waves of adiabatic discharge, are considered. To generate shock waves within the megabar pressure range the condensed high explosives, laser and curpuscular beams, high velocity shocks, and soft X-rays were used. The highly time-resolved diagnostics of the extreme states of matter were carried out with differential laser indicators of velocity, fast-acting electron-optical transducers, pyrometers, and high-speed spectrometers equipped with the electron-optical transmission lines. The obtained experimental data and based on the data physical-chemical models of behavior of matter at extremely high pressures, temperatures and deformation rates are discussed. These are the metallization and dielectrization of strongly compressed matter, high temperature thermodynamics and phase transitions, peculiarities of energy spectrum of compressed atoms and strength and elastic-plastic phenomena, kinetics of phase transitions. Based on the data the wide-range semi-empirical equations of state and the destruction, deformation and energy release models are constructed, which were used for multidimensional numerical simulation of pulsed high-energy processes.