Study of the equations of state for materials under extreme conditions at high pressures and temperatures: Outlook

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The equation of state for matter is necessary to solve various problems of high energy density physics using methods of continuum mechanics. The reliability of knowledge of the equation of state determines the correspondence between the results of numerical modeling and the available experimental information about the processes being modeled. Thereupon, the study of the thermodynamic properties of various materials under extreme conditions is of interest both for obtaining fundamental knowledge and for solving applied problems.

In the present communication, a brief overview of promising methods for experimental study and theoretical description of the thermodynamics of various materials at high pressures and temperatures is provided. Some results of measuring the parameters of shock-compression and isentropic-expansion waves in condensed media at high energy densities are considered. Examples of equation-of-state models based on different thermodynamic potentials and the results of calculations using these models are also given in comparison with available experimental data for some elements (aluminum, iron, molybdenum) and compounds (silicon dioxide, polystyrene). Finally, conclusions are drawn about the outlook for further research into the thermodynamics of extreme states of matter at high pressures and temperatures.