Doppler and pyrometric diagnostics of shock-compressed plasma of dense xenon

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Various gases are used as reference materials in the experimental determination of the state parameters on the isentropes of explosion products by the barrier method in the pressure range below 5 Gpa. The most widespread noble gases are argon, xenon, and krypton. Due to the development of computational modeling methods and tools, there has recently been a need to clarify the equation of state of explosive explosion products and, accordingly, reference materials. The introduction of Doppler diagnostic methods (microwave interferometer and PDV heterodyne interferometer) suggests that this problem can be solved if the areas of their applicability in studies of shock wave compression of gases are determined.

Experimental studies of the shock wave compressibility of xenon, initially located at a pressure of P_0=5 atm, in the range of mass velocities from 1.7 to 8.1 km/s using a heterodyne interferometer, radio interferometer and pyrometer, have been carried out. The fundamental possibility of detecting a shock wave in xenon using a PDV heterodyne interferometer above 2 km/s is demonstrated. The experimental data obtained on the shock wave compressibility of xenon are in agreement with the experimental results of other researchers and with the calculation results based on the chemical plasma model.

According to the results of measurements of the brightness temperatures of shock-compressed xenon, using an optical pyrometer, a manifestation of the shielding effect of uncompressed ionized xenon was detected.