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Sound Velocity in Shock-Compressed Samples and Equation of State of Tin

K.V. KHISHCHENKO, V.E. FORTOV, I.V. LOMONOSOV, JIHT RAS, Moscow, Russia, M.V. ZHERNOKLETOV, A.E. KOVALEV, A.B. MEZHEVOV, M.A. MOCHALOV, M.G. NOVIKOV, A.N. SHUIKIN, RFNC-VNIIEF, Sarov, Russia — Equation of state for matter over a wide range of pressures and temperatures is required for simulations of processes in shock-compressed media. In the present study we have obtained data on the sound velocity behind the shock-wave front in tin at pressures $P \simeq 77 \div 138$ GPa. In measurements we have used a shock and rarefaction overtake method with CCl$_4$ and C$_8$F$_{16}$ as the analyzer liquids. We propose a semiempirical equation of state for tin with taking into account the polymorphs transformation, melting, and evaporation effects. Calculation results are compared with the newly acquired and available experimental data at high energy densities. The multi-phase equation of state obtained can be used efficiently in modeling of physical phenomena at high dynamic pressures.

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