EMISSION OF SHOCK WAVE IN SILICON IN A TWO-WAVE CONFIGURATION

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Measurements of the radiation of the shock wave front provide important information about the temperature of the shock-compressed matter and, when measuring the kinematic parameters of the wave, obtain information about the thermodynamically complete equation of state of the matter under conditions of high dynamic pressures [1]. To calculate the temperature of the substance, additional information about the emissivity of the surface is also needed. Observation of shock wave radiation is possible in optically transparent materials. In the present work we studied the thermal radiation of silicon during shock compression in the range of its optical transparency in normal conditions $\Delta\lambda_1 = (1.1 \div 1.7)$ μm and unloading in the ranges $\Delta\lambda_1 = (1.1 \div 1.7)$ μm and $\Delta\lambda_2 = (0.32 \div 1.06)$ μm. The shock wave in silicon was created by unloading a copper target compressed to a shock compression pressure of ≈160 GPa. The unloading of copper into silicon formed a shock wave with a pressure of ≈68 GPa, which has a two-wave configuration in silicon [2]. Silicon samples of 0.35 mm and 3.0 mm thickness were used. The presence of a two-wave configuration was evident in the emission when the wave enters the silicon sample and when the waves exit to the free surface. The temperature of the silicon when unloaded into vacuum was measured in the visible and infrared ranges. In an additional experiment, the reflection coefficient of the shock wave front in silicon was measured. The measured temperatures are compared with estimates from the data of [2], the equation of state of silicon similar to [3] and calculations by molecular dynamics methods [4].

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