Power potentials for constructing polymorphic equations of state of polycrystals

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Within the framework of power potentials, two approaches to the construction of equations of state of polycrystalline substances were considered. These approaches were implemented using the polymorphic phases and melt of silicon dioxide (SiO_2) as an example. As a result, the low-parameter polymorphic equations of state were built for it.

Experiments on shock compression of monocrystalline samples of SiO_2 were carried out using explosive cumulative generators [1]. The shock compressibility of the samples was determined by impedance matching with aluminum standard, wave velocities were measured using a time-of-travel optical technique. The brightness temperature of shock front was recorded by a high-speed optical pyrometer.

The adequacy of the constructed equations of state was checked by comparing the results of calculations taking into account polymorphic transitions and melting, with the experimental data on the phase diagram and shock Hugoniot of silicon dioxide. It has been found that the Murnaghan equation approach is more preferable for constructing of phase diagrams in the region of moderate pressures. However, in the region of high pressures, the approach to constructing equations of state in the form of Mi – Gruneisen allows us to obtain a good correspondence between the calculated and experimental data on shock adiabat.

[1] Nikolaev D, Ternovoi V, Kim V and Shutov A 2014 *J. Phys.: Conf. Ser.* **500** 142026