

THEORETICAL COMPUTATION MODEL OF COMBUSTION IN SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS MODE

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The main question of the theoretical computational analysis of self-propagating high-temperature synthesis is determination of the temperature fields produced in the SHS process and finding the final phase composition of the reaction product. Since the SHS regime is a multistage regime, each stage of the process corresponds to a certain temperature regime, knowing the temperature distribution over the volume of the synthesized substance, it is possible to predict the phase composition and properties of the resulting material.

To address this question, we used the model [1], based on the solution of the nonstationary two-dimensional heat equation (1), which is a boundary value problem for which it is necessary to set the boundary conditions. This model is a system of solutions of this equation, based on two methods: the finite difference method and the tridiagonal matrix algorithm.

$$a(T) \cdot \left(\frac{\partial^2 T}{\partial r^2} + \frac{1}{r} \cdot \frac{\partial T}{\partial r} + \frac{\partial^2 T}{\partial z^2} \right) + \frac{q_v}{C(T) \cdot \rho} = \frac{\partial T}{\partial t}, \quad (1)$$

The main distinguishing feature in solving the heat conduction equation is the use of a mobile spatially distributed source of volumetric heat release, as well as the temperature dependence of the heat capacity, determined using the quantum Debye model, which makes it possible to relate the temperature to the parameters of preparation of the initial component charge. The temperature regimes of the flow of SHS reactions in boron-containing systems were determined in the course of the theoretical calculation analysis.

REFERENCES

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