COMPARISON OF FINITE ELEMENTS AND MESHLESS METHODS FOR MODELING OF SOLID PHASE CHEMICAL REACIONS UNDER EXPLOSIVE LOADING*

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Perspectivity of solid-phase reactions under explosive loading [1] consists in that such mode of course of reaction allows to provide non-equilibrium modes of reaction at high pressures and temperatures. This makes it possible to obtain materials with unique properties and structure. However, the extreme conditions of such reactions and the short time of the process require careful mathematical simulation of the corresponding processes in order to control and predict the reaction results.

To solve a wide range of problems in the mechanics of continuous media, the finite element method has been the main numerical method for a long time [2,3]. However, meshfree methods, in particular the smoothed particle hydrodynamics [4-7], have been gaining popularity in recent years.

This paper compares the results of modeling a solid-phase chemical reaction in detonation mode obtained by the finite element method [1] with different variants of the smooth particle method.

At modelling of shock-wave loading the deformation of a design grid leading to instability of the solution is a disadvantage of the finite element method. In this case a computationally complex reconstruction of the design grid is required.

The advantage of the meshfree methods is that they do not use computational meshes. Their disadvantages include lower approximation accuracy.

The results obtained by SPH, CSPM, xSPH and variational SPH are considered.

The phenomenological model of a zero order chemical reaction is used [8], the mechanical properties of the reaction mixture and reaction products are described in the framework of the theory of multi-component mixtures [9]. The results of calculations by netless methods are compared with the results of modeling by finite element method and with some experimental data.

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