DISCRETE 3D-MODEL FOR GASLESS COMBUSTION*

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Experimental and theoretical studies of the discrete structure of gasless combustion waves propagating in compacted powder mixtures have been considered by many authors [1]. Mathematical modeling of discrete combustion waves is based on the representation of reaction cells in the form of areas of flat configuration. In the present study is developed a spatial physical and mathematical model of gasless combustion of samples with a discrete structure in the form of a rod. Two types of structural elements-cells are considered: donor and acceptor [2]. All reaction cells had a cubic shape and were evenly distributed in the sample. The characteristic cell size determined the scale of heterogeneity of the reacting system. Conjugate boundary conditions were specified at the internal boundaries of the reaction cells. The numerical study of the model was performed, stationary and non-stationary periodic combustion modes of the sample were described. The figure 1 shows the temperature field in the so-called "spin" combustion mode, when the combustion source moves along the side surface of the sample along a spiral trajectory. The linear average burning rates of the sample were calculated depending on the sizes of the structural elements. The burning rate of a sample consisting of large elements turned out to be higher than that of a sample consisting of small ones. This is explained by the relatively smaller number of transitions from donor to acceptor elements.

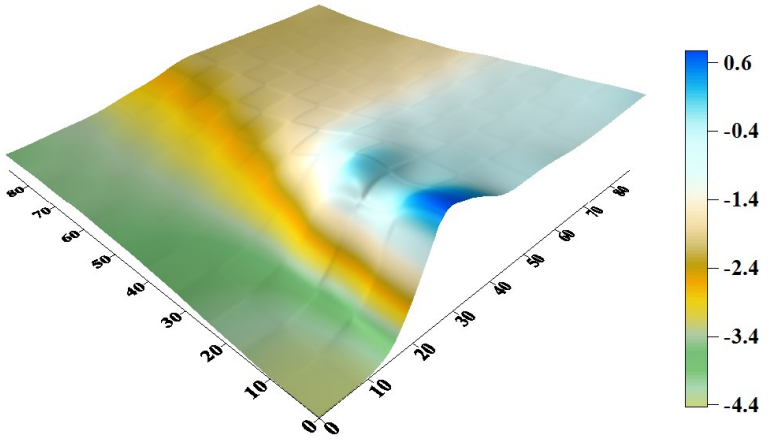

Fig.1. "Spin" regime of combustion. Temperature field.

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