# ELEMENTARY MODELS OF THE THERMAL INFLUENCE OF DIFFERENT FACTORS ON THE RATE OF LAYER-BY-LAYER PROPAGATION OF THE BURNING ZONE

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New perspectives for development of the physics of combustion of different systems can be related with the ideas of the thermal model of layer-by-layer propagation of the zone of exothermal and endothermal transformations of reagents. As one can see in work [1], the fractional-linear equation, which comes out from this model, has some important advantages over the parametric equations obtained on the basis of the theoretical ideas of the thermal model of propagation of the wave of an exothermal reaction. These advantages include the extrapolation properties of the equation as well as the accuracy and completeness of description of the experimental laws of combustion of any systems.

In this report the author has examined the elementary models of the thermal influence of different factors on the rate of propagation of the burning zone (RPBZ) with exothermal and endothermal transformations of the reagents (see Table 1). The author has also examined the characteristic dependences of RPBZ on different factors (see Figure 1).

Table 1

| Elementary models | Characteristics of factor components | |
|---|---|---|
| | Of the maximum enthalpy of reagents $h_m$ in the zone of heating | Of the density of heat flow $q_m$, which enters the zone of heating |
| I | endothermal | exothermal |
| II | endothermal | endothermal |
| III | exothermal | exothermal |
| IV | exothermal | endothermal |

The following conclusions can be made:

- in the typical models the dependences of RPBZ on different factors for any combustible systems are isomorphic;
- for endothermal factor components $h_m$, dominating in the model I, the dependence m(f) is decreasing and for exothermal factor components $q_m$ it is increasing;
- in the model IV there are critical values of factors; in the left and in the right parts of the neighbourhood of these critical values there are characteristic combinations of two phenomena: a) transition into explosion and extinction at dominating exothermal factor components $h_m$, b) extinction and transition into explosion at dominating endothermal factor components $q_m$.

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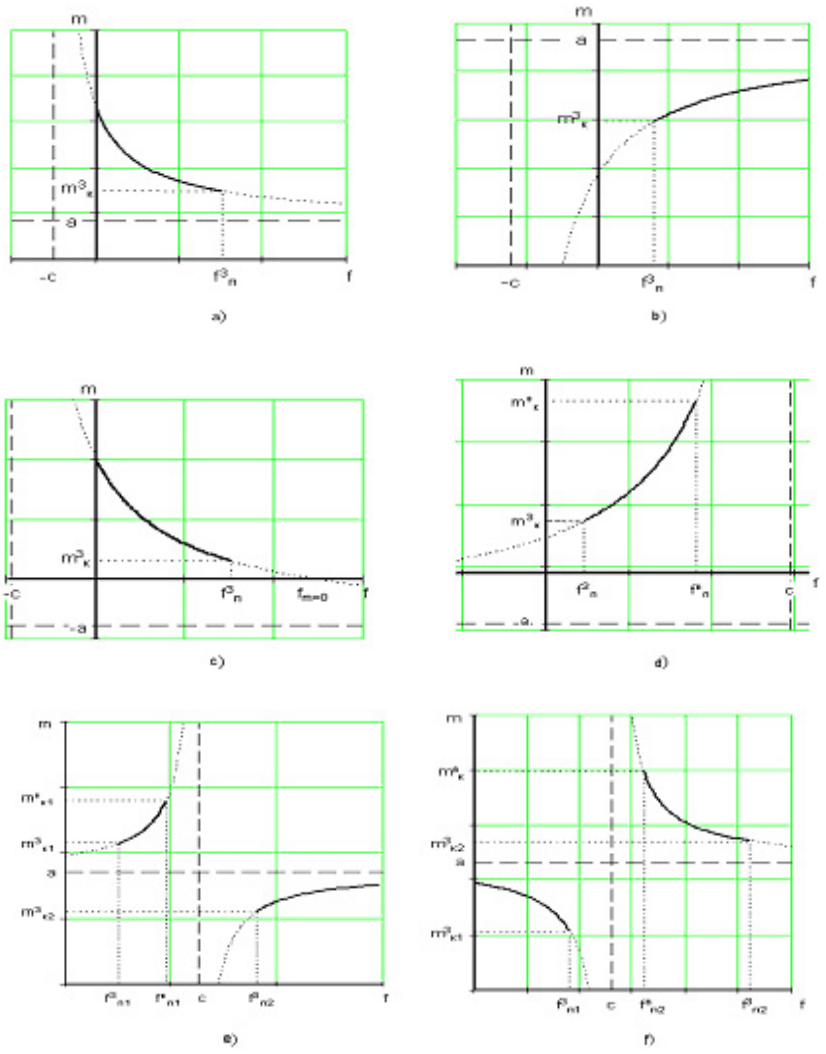

Fig. 1. Characteristic dependences of the rate of propagation of the burning zone on different factors for elementary thermal models:
a) with dominating endothermal component $h_m$ in the model I; b) with dominating exothermal component $q_m$ in model I; c) for model II; d) for model III; e) with dominating exothermal component $h_m$ in model IV; f) with dominating endothermal component $q_m$ in model IV

## References


[1] Kashporov L. Ya. Perspectives and problems of development of the combustion theory for pyrotechnic mixtures “Modern Problems of Pyrotechnics”, Sergiev Posad, 2003, p.331-332.