MODEL EQUATION FOR PROPAGATION OF CURVED PREMIXED FLAME FRONT

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The model equation describing the propagation of curved premixed flame front is considered and investigated. The equation takes into account a hydrodynamic instability of premixed flame front in Darrieus-Landau limit and nonlinear effect of propagation of curved flame front. The equation under consideration can be considered, as a simplified form of the Sivashinsky equation, however, unlike the latter, it is fair not only for small, but also for finite degrees of expansion of gas in a burning wave.

The analytical solutions of the equation are obtained. The dynamic properties of flame front and peculiarities of formation of cellular structure of a flame front are investigated. It is shown, that three characteristic periods can be selected in the process of development of flame front instability: the induction period, the period of the accelerated motion of flame front and the period of steady-state motion of cellular flame front with velocity several times exceeding the normal propagation velocity of flat laminar flame. It is shown, during the period of accelerated motion of flame front, the process of its propagation can be considered approximately as self-similar at which a mean velocity of curved flame front is approximately changed under the law $t^{1/2}$.

Two-dimensional cells on the flame front are considered. It is shown, that the steady-state form of a cell looks like either the parabolic cylinder, or a rotation paraboloid, or their combination, thus the steady-state cellular flame front can have either one-dimensional, or square or hexagonal structure.

The results of calculation are compared with well-known experimental data on propagation of curved premixed flame front.

The possibility of application of the model equation under consideration for modeling of propagation of premixed flame in turbulent flow is discussed.