TO THE THEORY OF IGNITION BY HOT SURFACE

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Abstract: The article comments on the results of research on the ignition of combustible gas by a heated body. In the classic work by Ya. B. Zel'dovich, using a steady ignition model, the main properties of the process were identified and the ignition criterion was obtained. Subsequent research mainly followed the path of numerical simulation using unsteady ignition models. The question remains open as to whether the ignition criterion obtained from the steady model can be applied to reproduce the experimental data. In the present article, the experiments, described in the S. Kumagai's book, on the ignition of a propane–air mixture by a heated cylindrical wire were calculated using the criterion derived on the basis of the Zel'dovich's steady model. But the experimental points fell on different curves corresponding to different wire diameters. Using the idea of stability theory that the appearance of an inflection point at the temperature profile results to ignition, the authors obtained a new criterion which correlates very well with the experimental data and enables one to get the parameters of the chemical reaction of ignition. The present authors believe that the criterion based on the inflection point will be useful for solving new problems of ignition and revise some old solutions.

Keywords: steady ignition theory; ignition criterion; conditions of ignition; propane–air mixture

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Figure Captions

Figure 1 Treatment of experimental data [3] on ignition of a propane–air mixture flow by a hot wire using the criterion (5) in dependence of wire diameter: *1* — 1.4 mm; *2* — 1; *3* — 0.7; and *4* — 0.48 mm

Figure 2 Treatment of experimental data [3] on ignition of a propane–air mixture flow by a hot wire using the criterion (9) in dependence of wire diameter: *1* — 1.4 mm; *2* — 1; *3* — 0.7; and *4* — 0.48 mm

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