

EXPERIMENTAL DETERMINATION OF THE OPTIMAL FOCUSING ZONES FOR LASER IGNITION OF BUTANE-AIR COMBUSTIBLE MIXTURES*

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Laser ignition is widely discussed and investigated subject today. Recently, in this area of research significant progress has been made. Though laser spark plugs already have practical application, nevertheless the main aspects of ignition of fuel mixtures by means of the laser, for example, the most advantageous position of focus in combustion chamber not fully explored. There are two modes of focusing of laser beam in combustion chamber: focusing in air in the volume of the chamber and focusing on the ablator. Fuel ignition at the first mode of focusing requires high power consumption, increasing the cost and the sizes of laser spark plug, at the second mode of focusing of energy of laser pulse for ignition of fuel it is required 10 times less, however the resource of the ablator is obstacle for realization of this method in practice. Therefore it is necessary to investigate the optimal zone for focusing of laser radiation in which it is possible to realize low energy-intensive ignition and at the same time without destroying the ablator.

In the work results of experiments on ignition fuel mixture (butane based) compositions with various equivalence ratios ($\varphi \sim 0.4-1.1$) and pressures ($p \sim 1-3$ bars) depending on the position of the focus ($l \sim 0-12$ mm) in combustion chamber concerning the ablator are presented. The change in the minimum energy of the laser pulse required for ignition the fuel mixtures is fixed and also with use Shliren's method dynamics development of burning core and propagation of shock wave at laser ignition (1064 nm, 12 ns) was investigated. It was revealed that the optimum zone of focusing of laser radiation where energy of laser pulse accepts the minimum values, was not on the ablator, and in some removal from it.

The received results are of interest to use of laser ignition in the practical purposes.

* The work was supported by the Russian Foundation for Basic Research (RFBR) grant No.18-38-20032.