EFFECT OF HYDROGEN TEMPERATURE ON IGNITION POSSIBILITY DURING SUDDEN RELEASE INTO AN AIR-FILLED CHANNEL

V. V. Golub[1], V. M. Anisimov[1], V. M. Bocharnikov[1], V. V. Volodin[1], S. V. Golovastov[1], A. E. Elyanov[1], V. A. Simonenko[2], V. V. Stakhanov[2]

[1]Joint Institute for High Temperatures of the Russian Academy of Sciences, Moscow, Russia

[2]FSUE «RFNC – VNIITF named after Academ. E. I. Zababakhin», Snezhinsk, Russia

The development of new hydrogen energy devices requires safety ensuring measures [1–2]. Currently, hydrogen self-ignition modes in obstructed channels are being studied [3]; however, the effect of hydrogen temperature has not been fully investigated. This work experimentally examined the influence of compressed hydrogen temperature on self-ignition during pulse release into an open channel filled with air. The jet was formed by rupturing a metal diaphragm separating the high-pressure chamber and the channel. The high-pressure chamber was preheated. The temperature varied from 20 to 150 degrees Celsius. The internal diameter of the tube varied at 6, 10, and 18 mm. The limiting pressure at which hydrogen ignition occurs was determined. Two scenarios of combustion development were identified, as well as its absence during hydrogen release from the channel. The capabilities of retroreflective shadowgraphy (fig.1) in studying pulsed hydrogen jets were demonstrated. One-dimensional gas-dynamic approximation calculations were performed to evaluate the contribution of high-pressure chamber heating to self-ignition conditions.

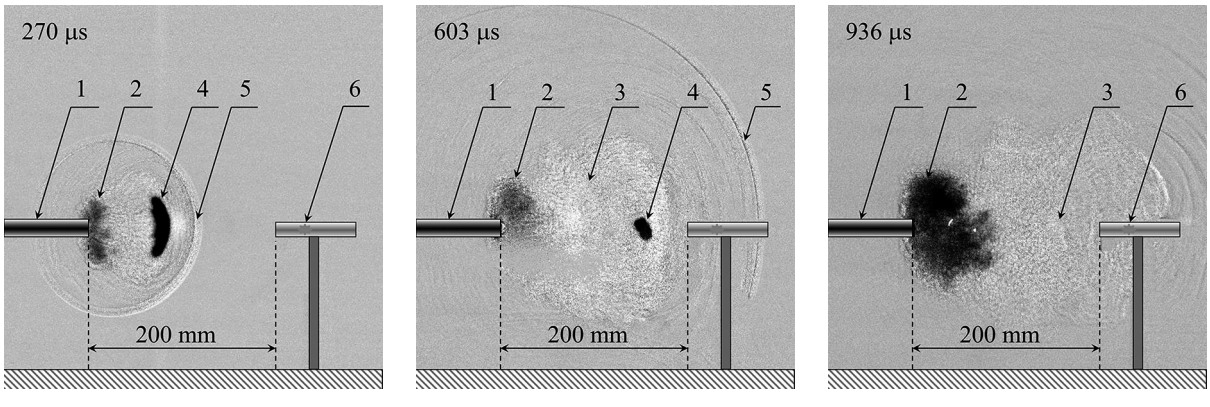

Fig. 1. Shadowgraph images of pulsed hydrogen jet:

1 – channel; *2* – flame at channel exit; *3* – gas ejecting from channel; *4* – combustion at the contact surface between hydrogen and air; *5* – shock wave; *6* – LED. Initial hydrogen pressure 5.7 MPa, initial hydrogen temperature 161°C, experiment with combustion

References

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