RESULTS OF EXPERIMENTS WITH HYDROGEN LEAKAGE INTO A LIMITED ROOM WITH DELAYED IGNITION

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Currently, the field of hydrogen energy is actively developing. Hydrogen production is carried out in various ways, but the most environmentally friendly way without the release of carbon dioxide is water electrolysis using electrolyzers. Storage and transportation of hydrogen is mainly carried out in the form of high-pressure gas using vessel. Electrolyzers and hydrogen cylinders can be placed in rooms with limited access. In case of emergency depressurization of the electrolyzer or high-pressure vessel, it is necessary that the ventilation system of the room ensures effective removal of hydrogen to avoid the occurrence of an explosive hydrogen-air mixture. To justify the safety of operation of facilities and develop measures to minimize emergency consequences, software codes and calculation methods are needed, which allow to take into account the parameters of emergency situations and assess the possible consequences [1].

In order to validate the program codes, it is of interest in the pest in the experiment, firstly, the dependence of the height of the hydrogen layer in the room over time to assess the dynamics of the mass of the flammable hydrogen-air mixture, secondly, the time to establish a non-flammable mixture in the room when the combustible gas flow is stopped, and, finally, the influence of natural and forced ventilation on the hydrogen content in the room.

In addition, in case of ignition of the resulting hydrogen-air mixture, data on the combustion of the hydrogen-air mixture in a limited room are required, in particular, excess pressure during explosion to assess the load on the walls of the room. This work is a continuation of the work [2], in which the distribution of hydrogen in a ventilated room was experimentally studied at the release of hydrogen with a constant flow rate and during the depressurization of a cylinder with hydrogen under high pressure.

As part of the current work, data on the distribution of hydrogen in the volume of the stand with forced ventilation were obtained. The dependence of the maximum volumetric proportion of hydrogen on the volumetric flow rate of ventilation in the room with a volume of 8 m^3 has been established. Experiments were also carried out to ifmine the hydrogen-air mixture in the room, which is formed after the jet flows out of a high-pressure cylinder up to 14 MPa. The influence of the total area of the drop windows on the value of the baric loads exerted on the walls of the room during the combustion of the hydrogen-air mixture was estimated.

It is recommended to use research results for validation of software package. The results obtained can also be useful in the creation of an engineering model of a ventilated room, in which the volume of the room, the size and location of the ventilation holes, the performance of forced ventilation and the consumption of the supplied hydrogen are the parameters.

References

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