EXPERIMENTAL DATA OF HYDROGEN JET FLAME LENGTH AT THE LEAKAGE FROM HIGH-PRESSURE VESSEL

V. V. Stakhanov, D. A. Mastyuk, E. V. Bezgodov, M. V. Nikiforov, S. D. Pasyukov, A. A. Tarakanov, I. A. Popov, Yu. F. Davletchin

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

To reduce carbon footprint, currently the hydrogen energetics are developed actively, within hydrogen using as means of energy accumulation, transportation, production and consumption. To storage and transportation of hydrogen, high-pressure vessels are used, in which hydrogen contained at pressure up to 70 MPa and vessels up to 100 MPa are developed. In case of an emergency with vessel depressurization, auto-ignition of jet [1] or ignition from weak energy source about 10^{-4} J is possible with formation of hydrogen jet flame, which length can be reached a few meter. To ensure of people and facility safety at emergency it is necessary to know a zone of thermal damage, that important for hydrogen especially, because it flame practically sightless with human eyes.

For detection of hazardous zone from hydrogen jet flame thermal effect it is interesting to investigate of jet leakage in momentum-dominated regime, because it formed at pressure about 0.2 MPa. The aim of this work is obtain of experimental data for estimation of hydrogen horizontal jet flame at leakage from high-pressure vessel. Experiments with hydrogen leakage through orifice of various diameter with and without ignition are carried out. The temperature and hydrogen pressure in vessel are measured. In experiments without ignition a hydrogen volume fraction in different points along discharge area are measured, and in experiments with ignition length of jet flame are determined using high-speed visible and infrared camera.

From a result of experiments without ignition the empirical equation for dependence of dimensionless length of hydrogen jet, in which the hydrogen content exceed lower flammability limit (≥ 4 vol.%), from pressure in vessel up to 15 MPa. From a result of experiments with ignition the empirical equation for dependence of dimensionless length of hydrogen jet flame from pressure up to 50 MPa. Maximum value of hydrogen visible length of jet flame are in a good agreement with relationship from paper [2].

References

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