IR VISUALIZATION OF GAS MIXTURE BURNING TO STUDY HYDROGEN SAFETY AND POWER ISSUES

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The report presents the results of activities conducted at the Scientific Research and Testing Complex concerning hydrogen power and safety.

The experimental fire and explosion hazard research complex was upgraded to perform works in hydrogen power and safety. The complex is designed for setting up target experiments and obtaining data on fire and explosion hazard of multi-component gas media. The complex allows experimentally obtaining data on the explosion parameters (pressure, temperature), conditions leading to initiation (ignition) of a gas medium (ignition source energy and type), and influence of the external factors (external heating, mixture dilution, and initial pressure) on the fire and explosion hazard.

During the tests carried out at complex, a method for measuring the above mentioned parameters has been developed to obtain quantitative characteristics of movements, velocities, and accelerations of burning front propagation using a thermal imager. The measurements of the burning front movement parameters are based on digital high-speed thermal imaging recording of electromagnetic thermal radiation of hydrogen mixture burning processes using an array temperature sensor, namely bolometer, and subsequent conversion of data from the sensor into a temperature distribution field image.

The application of the thermal imager for IR-visualization of gas media is shown on the test bed STRUYA when determining the thermal and geometrical characteristics of combustible gas jet accidental releases from high-pressure vessels, that are typical for hydrogen power facilities; at the BM-U facility when studying the processes of outflow and burning of steam-hydrogen-containing compositions in a large scale taking into account the technological features of hydrogen power facilities; and at fire complex to obtain the experimental data on the processes and fire effects on a cylinder filled with hydrogen as well as to study experimentally the influence of armor-piercing incendiary bullets on the cylinder filled with hydrogen.