



DETONATION IN THE FUEL-OXIDIZER FLOW IN THE PULSED COMBUSTOR

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ABSTRACT: Nowadays many scientific laboratories and aerospace research centers have a reasoned interest in developing absolutely new engines so-called “Pulsed Detonation Engines” (PDE) based on the use of detonation for combustible mixtures combustion [1–3]. PDE is a semienclosed tube which fills up with the combustible mixture, where a detonation wave triggers. Reaction products flowing out of the open tube end at a high speed, create the jet thrust.

The pulsed combustor (PC) – a model of the PDE – has been designed in the laboratory of physical-chemical hydrodynamics of A.V. Luikov Heat and Mass Transfer Institute of the National Academy of Sciences of Belarus. The PC is a semienclosed sectionalized steel tube 1 with a mixing chamber 2 (fig. 1) $d = 21$ mm in diameter and $L = 760$ mm in length. The ignition of the combustible mixture is carried out by an automotive spark plug. The PC is provided with a gaseous panel and a digital measuring system to control input parameters and signals on the actuating mechanisms, collection, processing and storage of test data.

The working process of the PC is of cyclical nature with the capacity to use different fuels.

The detonation wave velocity in the tube can be determined using the basic method of the signals of three piezoelectric pressure gages Piezotronics PCB (fig. 1). The gages are placed along the tube and form two measuring bases: $L_1 = 213$ mm and $L_2 = 160$ mm in length (in the direction of flame front).

Different conditions of detonation excitation and progress were studied in the PC. Pressure and detonation velocity on the two bases along the PC were measured. It is established, that detonation velocity in the hydrogen / oxygen / air mixtures makes 1800-2500 m/s depending on the PC configuration, the initial conditions and the equivalent coefficient ($\phi = 0,65-1,82$).

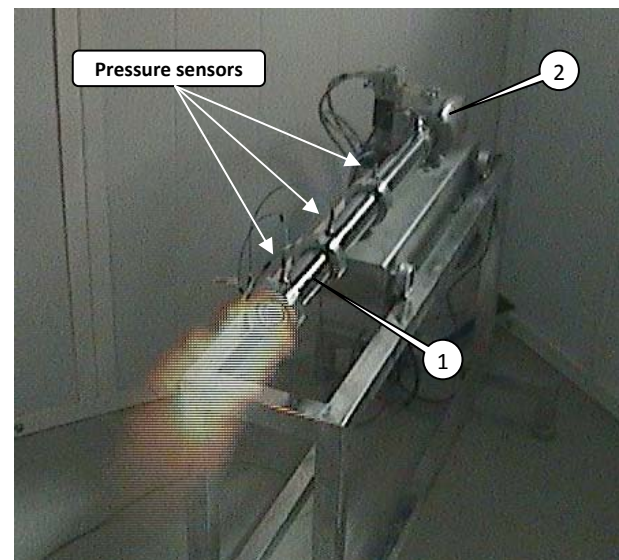


Fig. 1. General view of pulsed combustor

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