Spectrozonal diagnostics of powdered aluminum combustion processes in the air stream

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When designing ramjet engines, the problem of optimizing the model engine design often arises. Optimization is improving the quality of the working process of fuel combustion in the combustion chamber. The criterion for its estimation can be the temperature of the combustion products (CP): its value and the distribution in the chamber volume. Measurement of the CP two-phase flow temperature is associated with certain difficulties, since using contact methods does not provide reliable information about temperature due to the effect of the condensed phase on the sensitive element, and also due to the uncertainty caused by the CP temperature non-equilibrium. It seems promising to use contactless methods for measuring temperatures, in particular optical pyrometry methods. The technique of spectrozonal video shooting is developed. It allows determining the temperature fields in the space of a model ramjet combustion chamber equipped with a flat transparent element for visualization. What is more, the determination of the temperature is carried out simultaneously separately for the solid and gas phases due to using a special optical stereo attachment doubling the image and allowing each image to be recorded at two different wavelengths using two interference filters. Each of them is designed to record the radiation of the k-phase or gas (at the radiation wavelength of the sodium doublet of 589 nm).The processes of ignition and combustion of the air suspension of aluminum particles ASD-1 in the ramjet combustion chamber were chosen as the object of investigation. The description of the experimental setup for spectrozonal filming (video shooting) intra-chamber work processes is given, the layout and description of the experimental section with the location of the optical stereo attachment and the video camera, as well as imaging scheme in the mirror system are described. The techniques and results of processing the workflow shots for two different modes are presented. The analysis of processing results is given.

Keywords: *ram jet, optical pyrometry, two-phase flow, temperature nonequilibrium*

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