EXPERIMENTAL OBSERVATION OF THE INSTABILITY MODE IN THE COMBUSTION WAVE BY THE DIFFERENTIAL CHRONOSCOPY METHOD *

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The aim of this study is to report on the observation of the spin instability mode during the propagation of a combustion wave in a mixture of Ni and Al powders. The paper presents the results of temperature and velocity measurements during the propagation of a SHS combustion wave [1], obtained using a special television micropyrometer (1200 x 800 pixels) with high spatial (5.85 μm / pixel) and resolution time (1 ms / frame) [2]. High accuracy of temperature measurement was ensured by using the new spectral-light pyrometry method (Patent RUS 2616937) from 800 to 2000 ºC, with an error of less than 1% [3].

For processing the experimental video data, the differential chronoscopy method (DCS-map) was used [4], which allows to select the image of the combustion front in the form of a continuous line with nodal points where the spin instability of the combustion wave is observed. An example of a DCS-map is shown in Figure 1.

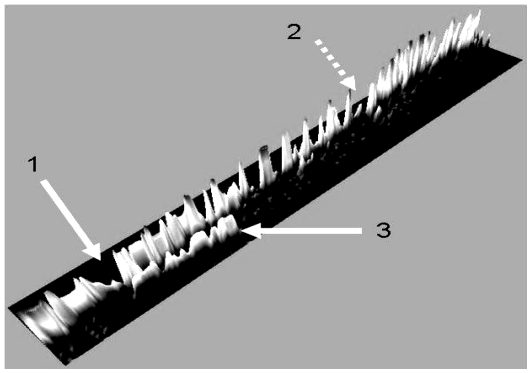

Fig.1. DCS-map of spin instability: 1- node of “strong” instability; 2 - node "weak" instability; 3 - a branch of a part of the combustion front in the direction of the opposite spin.

The appearance of nodal points of spin instability is a sign of a transition from a thermal instability mode to a diffusion instability mode of a combustion wave, which is explained by the phenomenon of thermal hysteresis of the combustion wave velocity from the synthesis temperature [4].

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