FAST COMBUSTION MODES OF COMPOSITES "MOUND OF POROUS SILICON FRAGMENTS – SODIUM PERCHLORATE MONOHYDRATE" IN THE ATMOSPHERE

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Abstract: One of the criteria for the development of high-energy processes is the large specific surface area of the solid component of composites. Therefore, the maximum preservation of its nanostructured skeleton when separating the porous layer from the monocrystal substrate is relevant. Based on the analysis of the quality of the porous layer under various methods and modes of its formation, two methods were selected that provide simple and effective separation of the porous structure from the monocrystal. For composites based on mounds of porous silicon (pSi) fragments (MPSF), three series of experiments were carried out with fragments of porous layers of different age (formed within the previously established time limits before composites creation) with registration of combustion dynamics, temperatures and combustion spectra, as well as intensity of disturbances in the atmosphere forming during combustion of MPSF-composites. Four combustion modes of MPSF-composites were established: smoldering, frontal, aerosol, and frontal-aerosol. The ignition induction times were determined: from 1 to 50 μs, pressure pulses in the atmosphere at a distance of 260 mm from the ignition site — up to 1.6 bar (with a mass of composites up to 0.4 g). Combustion velocities of MPSF-composites and their dependences on the coefficient of stoichiometry and humidity of sodium perchlorate monohydrate are established.

Keywords: MPSF-composites; combustion; pressure; solid fuel; combustion spectra; temperature; velocity; coefficient of stoichiometry

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