THE PROBLEM OF SLAG FORMATION IN ENGINES BASED ON PASTY PROPELLANT

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Abstract: The results of mathematical simulation of the process of slag formation in the chamber of the propulsion system on pasty propellant are presented. Using the optimization procedure, the parameters of small-sized engines based on pasty propellant designed to perform the assigned transport task were determined. Previously developed compositions were used as propellant. The mass of slag residues in the combustion chamber of propulsion systems was estimated. The results obtained allow one to conclude about the significance of the process of slag formation in the combustion chamber of an engine on pasty propellant. A tool for assessing the quality of a pasty propellant propulsion system has been created taking into account the phenomena of the multiphase flow evolution process in the combustion chamber of the engine. It is shown that the intensity of slag formation significantly depends on the parameters of condensed combustion products as well as on the law of the propellant burning rate.

Keywords: pasty propellant; engine based on pasty propellant; slag formation; agglomerate; condensed combustion products; burning rate

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Figure Captions

Figure 1 Schematic diagram of the engine on pasty propellant

Figure 2 Dependence of $r_b(p)$: *1* — modified binder; *2* — modified binder and activated carbon; and *3* — initial binder

Figure 3 Evolution of combustion products [5]

Figure 4 Trajectories of agglomerates in the combustion chamber: (*a*) composition No. 3; and (*b*) composition No. 2

Figure 5 Agglomerate mass deposition fluxes: *1–3* — compositions 1–3

Table Captions

Table 1 Results of the optimization task

Table 2 Characteristics of condensed combustion products

Table 3 Slag residue mass

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