The mathematical model of gas dynamics of burning aluminum diboride particles in a high-speed oxidative gas-flow

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For development of fuel compositions with a high content of metallic components it is necessary to know macrokinetic characteristics of the processes of ignition and combustion as the individual particles of powdered metals, and their complexes. The objective of this study is to simulate the processes of ignition and combustion of a single particle metallize fuel—aluminum diboride (AlB₂) in a high speed oxidative flow. The condition for complete film evaporation of the boron oxide or the condition for achieving aluminum oxide melting temperature is considered as criterion of ignition. We found the dependence of the initial values AlB₂ particle diameter and air temperature of time of ignition and combustion induction time. Calculation method which allows determining the completeness of combustion and combustion time particles in surroundings with complex chemical composition was developed for simulate the movement of reactive AlB₂ particles in a high-speed flow. The two-phase flow characteristics calculation is carried out for a fixed control volume in local thermodynamic equilibrium assumption. As a result of the numerical calculation, dependences on parameters of particles time of stay and time burn particles in the channel are obtained. Temperature field and the velocity of the gas and the dispersed phase for different times corresponding to different flow area channel are determined. This work was supported by grants of leading scientific schools of Russia project NSh-9774.2016.8.