SIMULATION OF THE COMBUSTION PROCESS OF BIOFUEL PELLETS IN THE UPWARD AIRFLOW

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The purpose of the work is to determine the thermal performance of the combustion process of biofuel pellets in the upward air flow. Granules from straw of grain crops are considered as a promising fuel. The difficulty in implementing the process of their combustion is associated with a relatively low ash melting point. One of the possible solutions to this problem may be the organization of the process of burning pellets in the upward air flow. To obtain relevant data on the course of this process, numerical modeling of aerodynamics and heat and mass transfer in the upward air flow with solid particles of biofuel during their combustion is performed.

The results. Numerical simulation is performed on the basis of the developed algorithm for the finite-difference solution of a system of equations for an air flow with solid particles. This system includes the equations of the dynamics of turbulent air flow, as well as the equation of heat transfer and mass transfer for the gas phase. The motion of solid particles is described in Lagrange coordinates. For each particle, the equations of conservation of momentum, mass and energy are composed. The ascending two-phase flow is considered in a model prismatic channel with a variable cross section. Studies were conducted for different values of air velocity in the inlet section of the channel. Based on the results, we obtained velocity fields in the airflow, as well as trajectories and velocities of biofuel particles. The numerical model of combustion of biofuel particles takes into account the processes of evaporation of moisture, the release of gaseous volatile substances and their combustion in the ascending airflow. The carbon residue resulting from the decomposition of biomass also burns in the ascending gas stream. According to the results of numerical studies, the temperature regime in the model combustion chamber was determined. The distribution in the combustion chamber of temperature and the concentration of gaseous substances resulting from the pyrolysis of plant materials and burning of volatile substances and carbon residue was determined.

Conclusion. From the results of numerical studies of the combustion of biofuel pellets from straw, it follows that at certain values of the air flow rate in the combustion chamber, it is possible to set the temperature that ensure stable combustion of the biofuel pellets, which is lower than the temperature of melting of the ash.

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