Modeling of coupled heat-mass exchange and combustion of solid hydrocarbons gasification products and high-enthalpy air flow

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The present work is devoted to computational modeling of mixing and combustion of solid hydrocarbons gasification products and high-enthalpy air flow in the uniform cross-section channels. The coupled heat-mass exchange with regenerative cooling system is considered in the model. The main goals were the development of complex mathematical model and receiving the regularity of integral quality factors change. The methodological aspects of computation of mixing and combustion effectiveness coefficients are presented in this work. The models are based on the Favre-averaged Navier–Stokes equations for non-steady flow in accordance with turbulence. Combustion is determined by quasi-global reaction. One-dimensional mathematical model of non-steady coupled heat exchange in the cooling system is constructed with respect to longitudinal and cross-section flow non-equilibrium state in consequence of gasification products destruction. On the basis of numerical modeling analysis, the main operating and geometry parameters are obtained that correspond to effective combustion process and acceptable thermal state of the channel walls.