Numerical Droplet Cooling Simulation of Methane Conversion into Syngas Products

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The paper presents the results of theoretical investigations of heat and mass transfer at cooling the synthesis gas obtained after the partial methane combustion. Rapid synthesis gas quenching is necessary to prevent soot deposition on the reactor walls. In the proposed scheme, cooling is carried out by water droplets injection into the cooling chamber volume downstream of a burner device. At a two-velocity and two-temperature approach a closed system of equations for aerodynamics, heat and mass transfer of synthesis gas and droplets was derived. A droplet cooling efficiency was evaluated on the basis of a one-dimensional system of equations for aerodynamics and heat and mass transfer of a two-phase dispersed flow. Calculations results for various cooling system operation modes are presented.

Keywords**:** *enthalpy of vaporization, aerodynamical resistance, heat and dynamic relaxation times, evaporation rate, balance equations of momentum, enthalpy and mass, Fischer — Tropsch synthesis process of heavy hydrocarbons*

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