Abstract

The thesis and attached papers deal with some aspects of numerical modeling of plasma jet generated by plasma torch and also with numerical modeling of processes in thermal plasma reactor. All flows are considered to be turbulent in all simulations except for special cases. First part of the thesis is dedicated to short introduction to the topic and to description of turbulent physical models that are used later in all next simulations. Second part is dedicated to description of physical experiment itself and to results that were obtained from numerical simulations. More details are given in following papers that concern 2D and 3D simulations of mixing of steam plasma jet with steam atmosphere, with nitrogen and simulation of gasification of wooden particles by steam plasma jet in thermal plasma reactor. Standard, RNG and realizable k-ε models, and standard k-ω model were used for most of the simulations. Steam plasma and nitrogen transport and thermodynamic coefficients used in the computations were determined under the assumption of existence of LTE. Results for temperature, velocity and density distributions are discussed in each modeling and presented as images obtained from the FLUENT code, for currently used reactor geometry setup and plasma jet characteristics. Centerline temperature of steam plasma jet at the reactor input was approximately 23 000 K and mean inflow plasma velocity was approximately 2600 m/s in all simulations. The modelling simulates conditions in experimental reactor for biomass gasification in preheating phase and also during full experiments of gasification.