Development of an Euler-Lagrangian simulation of a circulating fluidized bed reactor for Shubarkol coal gasification case study

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A Computational Particle Fluid Dynamics (CPFD) model based on the Multiphase Particle in Cell (MP-PIC) approach is used for a Shubarkol coal gasification case study in an atmospheric circulating fluidized bed reactor. The simulation was developed on a basis of experimental data available from biomass gasification process. The cross-section of the reactor riser is 0.2 m and the height is 6.5 meter. The Euler-Lagrangian simulation is validated using experimental data available in the literature and compared with a Euler-Euler simulation. The gasificaiton reactions kinetics model is improved. Homogenous and heterogeneous chemistry are described by reduced-chemistry and the reaction rates are solved numerically using volume-average chemistry. The simulations reveal gas composition, temperature, and pressure interdependencies along the length of the reactor. The product gas composition compares well with the experiment and the temperature profile demonstrates good consistency with the experiment. The developed model was then used for a case study of Shubarkol coal gasficiation in the circulating fluidized bed reactor.