

P. Morawiecki, "Simulation of wood pyrolysis in chosen experimental reactors", Master Thesis, Warsaw, 2018

Abstract: Biomass heated to the high temperatures in absence of oxygen undergoes a series of chemical reactions, making up the pyrolysis process. During these reactions complex organic molecules (like cellulose, hemicellulose and lignin) are transformed to simpler molecules, forming charcoal and flammable gases among others. The purpose of this work is to numerically simulate the processes occurring inside the experimental reactors and compare the results of the simulations with the experiments. The numerical results accurately reconstructed all phases of the process, the direction of reaction front and the flow of the gas inside and around the wood particle. Moreover, a significant relationship was found between the gas flow in the reactor and the dynamics of chemical reactions occurring inside the particle. The developed simulations can be considered as the first step toward the optimization of industrial processes for obtaining charcoal and wood gas.

Key words: pyrolysis, biomass, wood, finite volume method, fluid dynamics, porous media, Arrhenius equation, chemical engineering, scientific computing