SIMULATION OF WOOD COMBUSTION IN A FIXED BED USING CFD-DEM COUPLING (XDEM)

Amir Houshang Mahmoudi[1] , Miladin Markovic[2], Bernhard Peters[1], Gerrit Brem[2]

[1]Faculty of Science, Technology and Communication, University of Luxembourg
[2]Energy Technology, University of Twente

ABSTRACT

During the recent years the use of biomass in energy production is the center of attention in both academic and industry, since it is expected to play an important role as an energy source in the future.

In order to further improve the performance of gasifiers, it is necessary to gain insights into the highly complex processes during combustion of biomass. Even though many researches in this field have already been undertaken, the detailed mechanisms during the interaction between the gaseous and the particulate phase are still not well understood. During combustion of biomass in a fixed bed, each particle experiences sequence of processes such as heating, drying, pyrolysis and char combustion. Furthermore in the gas phase the pyrolysis products may react with oxygen and produce heat. The aim of this investigation is to propose a novel numerical model to address high level of detailed information about all the phenomena occur during combustion of biomass. XDEM as an Euler-Lagrange model is used, in which the fluid phase is a continuous phase and each particle is tracked with a Lagrangian approach.

Energy, mass and momentum conservation is applied for each single particle and the interaction of particles with each other in the bed and with surrounded gas phase are taken into account. Hence the sum of all particle processes represents the entire process like of a fixed bed. An experimental test is carried out to measure different characteristic of the fixed bed combustion of the biomass. In order to validate the presented model, simulation results are compared with the measurements. Very good agreement between prediction and measurements was achieved which proves the accuracy of the model in modeling of biomass combustion.