Numerical simulation of coal gasification in entrained flow gasifiers with coalFoam

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Abstract

Coal gasification is at present one of the most promising technologies envisioned for future power plants that are required to lower emissions deploying CCS (Carbon Capture and Storage). Furthermore, there is the possibility to combine production of electricity and chemicals. These goals can be obtained in Integrated Gasification Combined Cycle power plants (IGCC). Hence, a reliable gasification is the key process to higher efficiency and fuel economy.

In the course of several research projects the fundamentals of the behaviour of coals and other heterogeneous reactants at very high temperatures and pressures as well as reducing conditions is investigated. The results will be used in CFD (Computational Fluid Dynamics) simulations.

For the development of a suitable CFD-code OpenFOAM was chosen. On the basis of a standard solver coalFoam was implemented in cooperation with ICE Strömungsforschung [4].

The gas-phase reactions and the thermochemistry are to be derived mainly from two software packages – Cantera [3] and ChemApp© [1]. Both chemistry-packages are coupled with OpenFOAM® [2,5].

More details of the implemented models in coalFoam could be found in [6].

The next step is to integrate thermo-chemical calculations of the ash and slag reactions of the lagrangian particles to coalFoam.

The current paper will present the latest status of coalFoam, validation and calculation results and give an outlook for further work in that field.

Key words: coal gasification, reactive flows, particle tracking, kinetics

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