**THREE-DIMENSIONAL MULTIPHASE MODELING OF THE DESULPHURISATION PROCESS IN A COAL BUBBLING FLUIDISED BED**

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**ABSTRACT**

Computational fluid dynamics has proven to be a viable tool for simulating the processes that take place in fluidised beds. Increased computational power allows for non-invasive simulations for complex geometries and wide parameter ranges to be carried out which would be difficult and expensive to perform experimentally. Whilst Eulerian-Lagrangian modelling of the gaseous and particulate phases provides detailed information of the particle dynamics on a micro-scale its application to fluidised bed technologies is computationally exhaustive due to the large number of particles present within the bed. Eulerian-Eulerian modelling reduces the computational time and expense significantly and the inclusion of the kinetic theory of granular flow provides information on the particle collisions thus proving to be a viable tool for the modelling of fluidised bed technologies. Its utilisation in the studies of hydrodynamic and heat transfer processes in fluidised beds has been widely researched, however, the inclusion of reaction kinetics is still in the early stages due to its complexity.



The present work expands on our previous two-dimensional work to consider a three-dimensional Eulerian-Eulerian model of the gasification processes in a coal bubbling fluidised bed including SO2 as an additional species. Its presence in the reactor activates the desulphurisation process which follows the previously introduced limestone calcination process. Such processes are important for the reduction of harmful SOX emissions, therefore the production of a model capable of predicting such reactions is advantageous for the optimisation of reactor designs and operating conditions. The three-dimensional results presented provide a better representation of the flow dynamics over the previously considered two-dimensional simulations. Four different operating conditions (Fig. 1) are tested and the exiting compositions of the gases are compared with experimental results whilst the effects of additional calcination and desulphurisation models on the concentration of the emissions and computational times are given.