

Oxyfuel Combustion for CO₂ Capture - 10 kW_{th} Combustor Experiments with CFD simulations

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Abstract

Oxyfuel combustion (also called O₂/CO₂ recycle combustion) for CO₂ capture has been experimentally investigated in the BTS test rig at University of Stuttgart with the goal of providing detailed measurement data for analysis of combustion characteristics and validation of CFD (Computational Fluid Dynamics) modelling tools. Lausitz lignite was used as the fuel with an input of about 10 kW.

The results showed that the overall combustion behaviour for the 21 per cent and 35 per cent oxygen cases is rather similar to that of the air firing case for the system studied. In the present study, without flue gas recycling, the thermal effects caused by the CO₂ rich environment seem to exceed the chemical effects. The resulting burnout efficiency is satisfactorily and nearly the same for all cases, which is to be expected for a heated furnace such as the studied. The results from the CFD calculations show a relatively good agreement between measurements and calculations on global basis, considering the uncertainties in the measured data.

The tests also provided valuable insight required to make necessary changes in the experimental set-up required to provide more information from future tests, most importantly to minimise the used measurement techniques influence on the flow pattern and temperature distribution in the reactor.

Eventually, the tests should be moved to a larger test rig with possibilities of a real flue gas recycle to further study the chemical effects of flue gas recycle.