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PRESSURISED FLUIDISED BED GASIFICATION EXPERIMENTS OF BIOMASS AND FOSSIL FUELS

ABSTRACT

Gasification of biomass and older fossil fuels, like brown coal, hot gas cleanup using a ceramic filter and combustion of LCV product gas in a combustor was performed using a 1.5 [MWth] test rig (PFBG) at Delft University and a 10-50 [kWth] at Stuttgart University (DWSA) in the framework of experimental pilot plant research on efficient, environmentally acceptable large scale power generation systems based on fluidised bed gasification technology. The influence of operating conditions (pressure, temperature, stoichiometric ratio) on gasification performance (gas composition, conversion grades) was studied. The gasifiers were operated at pressures in a range of 0.15 - 1.0 [MPa] and maximum temperatures of circa 900 [°C]. The Delft gasifier has a 2 [m] high bed zone (diameter of 0.4 [m]) followed by a freeboard approximately 4 m high (diameter of 0.5 m). The IVD gasifier has a diameter of 0.1 [m] and has a total reactor length of 4 [m]. Both gasifiers are equipped with a hot gas cleanup ceramic filter and a pressurised combustor. Measurements are compared with a model based on homogeneous elementary reaction chemistry and heterogeneous gas-char reactions related to emission of environmentally harmful components like fuel-nitrogen derived species. Results obtained are presented and analysed. Carbon conversions were well above 80 [%]. Fuel-nitrogen conversion to ammonia is above ca. 50 [%] and the highest for biomass in comparison to solid fossil fuel. The results are in-line with other pressurised fluidised bed gasification investigations with bottom feeding of biomass. Significant deviation with top feeding occurs. Measurements and model were in quite good agreement with each other.

KEYWORDS

fluidised bed, gasification, simulation, biomass, hot gas cleaning

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