Behavior of Alkali Metals and Ash in a Low-Temperature Circulating Fluidized Bed (LTCFB) Gasifier - DTU Orbit (16/12/2018)

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A low-temperature circulating fluidized bed system (LTCFB) gasifier allows for pyrolysis and gasification to occur at low temperatures, thereby improving the retention of alkali and other inorganic elements within the system and minimizing the amount of ash species in the product gas. In addition, the low reactor temperature ensures that high-alkali biomass fuels can be used without risk of bed defluidization. This paper presents the first investigation of the fate of alkali metals and ash in low-temperature gasifiers. Measurements on bed material and product gas dust samples were made on a 100 kW and a 6 MW LTCFB gasifier. Of the total fuel ash entering the system, the largest fraction (40–50%) was retained in the secondary cyclone bottoms, while a lower amount (8–10%) was released as dust in the exit gas. Most of the alkali and alkaline earth metals were retained in the solid ash, along with Si and a minor fraction of Cl. Most Cl and S were released in gaseous form, with chlorine partly as methyl chloride. The tar in the product gas from the LTCFB gasifier contained only negligible amounts of potassium and other inorganic elements. The release of condensed ash species from the system was controlled by the particle size and the cut size of the primary and secondary cyclones. A model accounting for the ash collection by the plant cyclones was shown to predict the product gas ash particle release reasonably well.

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