

Solid circulation characteristics in loop-seal of a dual fluidized bed reactor

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A dual fluidized bed reactor (a riser-combustor, a fluidized bed-gasifier) was designed and constructed to determine the hydrodynamic properties for coal and biomass gasification having 30 kW_{th} capacities. In the dual fluidized bed reactor, energy generated from the combustor is transferred by solid circulation to the gasifier for endothermic gasification reaction. Among non-mechanical valves, loop-seal is employed for many commercial circulating fluidized bed reactors. Therefore, in the present study, a loop-seal was installed at the bottom of the bubbling fluidized bed (0.285 m x 0.11 m x 2.13 m-high) and the solid (silica sand) circulation rate from the gasifier to the riser was regulated by aeration to the loop-seal. Solid circulation rate through the loop-seal increases linearly to a maximum value with increasing aeration rate. At the same aeration rate, the maximum solid flow rate can be obtained at a loop-seal height-to-diameter ratio of 2.0-2.5. The effects of solid inventory, solid circulation rate and gas velocities to the riser and gasifier on the pressure balance around the dual fluidized bed reactor have been determined. The obtained solid flow rate has been correlated with gas velocity, loop-seal aeration rate, and inventory of solids.