Hydrodynamic characteristics of interconnected fluidized bed reactors for chemical-looping combustion

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The chemical-looping combustion (CLC) has advantages of no energy loss for separation of CO_2 without thermal NO_x formation. CLC reactors could be designed by interconnecting fluidized beds since the process requires good contact between gas and solid phases and continuous smooth flow of solid materials between the two reactors, air and fuel reactors. Two types of interconnected fluidized bed systems were designed for CLC application, one system consists of a riser and a bubbling fluidized bed and the other one has a riser and two bubbling fluidized beds. Based on the reactivity data, design values for the reactor, solid circulation rate and solids inventory were determined for 0.2-0.5 kW lab-scale CLC reactors. The pressure balance diagram of the reactor is established for the stable bed operation. Solid circulation rates were varied to around 30 kg/m^{2}s by aeration into a loop-seal. As solid circulation rate is increased, solid holdup in the riser increases up to about 0.01. The gas leakage between the reactors should be minimized to prevent unwanted gases being diluted with flue gases from each reactor, and a typical leakage from the riser is found to be less than 1%.