Semi-continuous and continuous operations of chemical-looping combustion in an annular fluidized bed reactor

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Chemical-looping combustion (CLC) is an alternative thermal power generation system for provision against environmental regulation of greenhouse gases and it has advantage of no energy loss for separation of CO_2 without nitrogen oxide formation. This process consists of oxidation and reduction reactors where metal oxide particles are circulating through these two reactors. In this study, semi-continuous and continuous CLC operations were carried out in an annular shape fludized bed reactor. It is composed of two bubbling fluidized bed zones with core and annular sections for effective heat transfer between exothermic oxidation and endothermic reduction reactions. This system also provides enough residence time for each reaction and can be separated by each reaction zone. The selected metal oxides, NiO and Fe_2O_3 supported on bentonite were prepared for the CLC process. The combustion efficiency was determined based on the gas composition of CO_2, CO and H_2 in flue gas. Considerations of CO and H_2 are below 10% with NiO, while Fe_2O_3 exhibits lower reactivity.