Quality of NiO and Fe_2O_3/bentonite particles in a chemical-looping combustor

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The chemical-looping combustion (CLC), an alternative combustion of gas fuel, has the advantage of no energy loss for the separation of CO_2 without nitrogen oxide formation. The oxygen demanded in the fuel combustion is supplied by an oxygen carrier, which circulates between both reactors. In the present study, NiO and Fe_2O_3/bentonite particles were used for oxygen carriers in a lab-scale annular fluidized bed for chemical-looping combustion. Some analysis of the oxygen carrier particles before and after reduction with methane were carried out to determine the quality of the oxygen carrier particles. The chemical-looping combustion efficiency increases with increasing temperature and decreasing fuel flow rate. The crushing strength of the oxygen carrier particles did not change significantly, and particle agglomeration and fragmentation were not detected. Cyclic tests of the reduction and oxidation reactions were performed to compare the reactivity of the oxygen carrier particles and it is found that the reactivity of the particles did not much affected during the cycles. No new chemical compounds were detected that may indicate there is no irreversible reactions within the particles.