Water Splitting Reaction by Nickel, Iron, Cobalt, and Copper-Based Oxygen Carriers for Hydrogen Generation

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The chemical looping hydrogen generation (CLH) process is becoming an important method to produce high purity hydrogen; the effective performance of oxygen carrier is the key to successful implementation of CLH system. In the present study, four different metal oxides based on Ni, Co, Cu, and Fe have been used as an oxygen carrier for CLH in a bubbling fluidized bed. The completely reduced particles by hydrogen were exposed to a mixture of 50 vol % steam diluted in nitrogen, to study their activity to split water into hydrogen at high reaction temperatures in the range of 750-900oC, an online gas analyzer was used continuously to measure the composition of the exhaust gases from the bed. A thermogravimetric analyzer (TGA) was used to measure the oxygen carrying capacity of each metal oxide. The experimental results showed that the temperature can increase the activity to split water into hydrogen therefore enhancing the performance of the particles in the Steam Reactor (SR). The kinetics of oxygen carriers oxidation with steam were quantified by applying the generalized equation for the kinetics of solid state reaction.