# Feasibility study of the use of industrial by-product for application to chemical looping hydrogen production

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The chemical looping strategy for hydrogen production (CLH2) offers a potentially viable option for efficient fuel conversion to hydrogen with the simultaneous capture of CO2. Typically, this process uses an iron-based composite as an oxygen carrier and syngas or methane as a fuel. The environmental and economic concerns motivate the use of abundant by-product iron oxide and the industrial off-gas for CLH2. Here we showed that H2 could be simply recovered from the industrial off-gas in a circulating fluidized bed with a mixture of the inexpensive raw material of by-product iron oxide and sand particle. The fluidization of the by-product iron oxide powder, which showed poor fluidization behavior, is improved by adding 60 vol% of sand particle. The industrial off-gas was completely converted to CO2 and H2O in a two-stage fluidized mode with a solid reactant of Fe2O3 of the binary particles, and then H2 was produced by oxidizing the reduced by-product iron oxide powder with steam. The binary particles showed consistent catalytic activity under multiple redox cycles by providing macropores with a size of ~5 μm which facilitated gas diffusion.