Cite this work as ***Please cite this article in press as: International Journal of Hydrogen Energy (2017), http://dx.doi.org/10.1016/j.ijhydene.2017.02.141***

Conceptual design of a Ca-Cu chemical looping process for hydrogen production in integrated steelworks

J.R. Fernandez[a] , I. Martinez[b], J.C. Abanades[a], M.C. Romano[b]

(a) Spanish Research Council, CSIC-INCAR, C/Francisco Pintado Fe, 26, 33011, Oviedo, Spain

(b) Politecnico di Milano, Department of Energy, Via Lambruschini 4, 20156, Milano, Italy

KEYWORDS:

Hydrogen, Steelworks, CO2 capture, Sorption enhanced water gas shift, Chemical looping combustion

ABSTRACT:

A novel configuration of the CaeCu looping process is proposed for the production of a H2-enriched fuel gas by means of the sorption enhanced water gas shift (SEWGS) of blast furnace gas (BFG) in steel mills. CO2 is simultaneously removed from the gas using a CaO based sorbent. A Cu/CuO chemical loop supplies the energy required for the regeneration of the sorbent via the exothermic reduction of CuO with coke oven gas (GOG). The process is carried out in an arrangement of interconnected fluidized-bed reactors operating at atmospheric pressure, which allows for a solids' segregation step to be introduced that will reduce significantly the solid circulation between reactors A reference case study is presented, where the SEWGS is operated at 600 _C and the regeneration of the sorbent at 870 _C. About 27% of the BFG can be decarbonized in the SEWGS reactor producing 110 Nm3 of H2 per tonne of steel. A CO2 capture ratio of 31% with respect to the total carbon emissions in the steel mill can be achieved. More than 60% of the thermal input can be recovered as high-temperature heat, which could be efficiently recovered for producing
electricity.