ON THE NOVEL CHEMICAL SWITCHING REFORMING (CSR) REACTOR FOR HYDROGEN PRODUCTION WITH INTEGRATED CO2 CAPTURE

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Keywords: Fluidized bed, Gas switching reforming, hydrogen production, autothermal reforming

Membrane reactors has recently emerged as one of the most promising technologies for pure hydrogen production as these reactors integrate the catalytic reactions, mostly reforming and water-gas shift reactions for hydrogen generation, and separation through membranes in a single unit. This combination of process units brings a high degree of process intensification with additional benefits in terms of increased process efficiencies. Recently, a novel MA-fluidized bed reactor concept has been proposed for pure hydrogen production with integrated CO2 capture from steam methane reforming. The so-called Chemical Switching Reforming reactor utilizes an oxygen carrier which acts as catalyst and heat carrier to the endothermic reforming reaction and is periodically exposed to fuel/steam and air streams; when air is fed to the reactor, the oxygen carrier is heated by the exothermic solids oxidation reaction, this heat is then utilized in the fuel stage where endothermic reduction and catalytic reactions regenerate the oxygen carrier and produce syngas. A hydrogen perm-selective membrane (¨thin-Pd-membrane) is used to directly recover pure hydrogen produced during steam-methane reforming while simultaneously shifting steam reforming and water-gas shift reactions equilibria towards complete conversion at lower temperatures. The CSR concept brings large benefits in design simplification, scale up and ease of operation at elevated pressure.

This paper presents preliminary experimental tests on a lab scale CSR reactor (
Fig. *1*) without membrane operated under auto-thermal reforming (ATR) conditions. Experimental tests investigating the influence of reactor temperature, steam to carbon ratio and feed flowrate on the reactor performance will be presented.

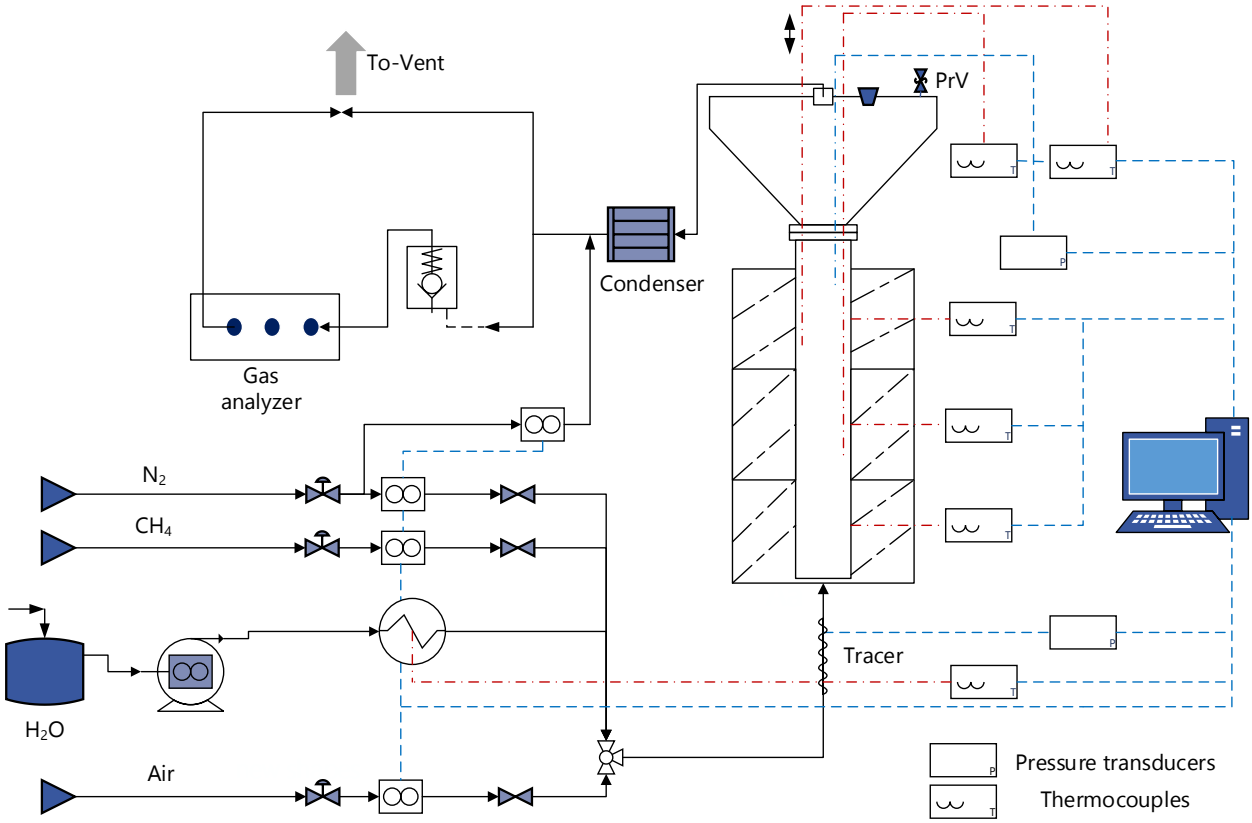

Fig. 1. Experimental setup schematic drawing of CSR

Reference

Gallucci, Fausto, et al. "Recent advances on membranes and membrane reactors for hydrogen production." *Chemical Engineering Science* 92 (2013): 40-66.