

CARBON DIOXIDE REFORMING WITH NATURAL GAS AND COAL USING CHEMICAL LOOPING TECHNIQUE

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Researchers are developing chemical looping technologies to convert carbonaceous fuels to high value chemicals and/or electricity with minimal CO₂ emission. These processes use a metal oxide or metal sulphate to partially or to fully oxidize the fuel source to the desired product while being regenerated with air and/or steam in a separate reactor. The chemical looping redox reaction pathway is capable of high product yield without the need for molecular oxygen and with minimal product separation costs. The Ohio State University is developing an advanced CO₂ reforming using the chemical looping technique to produce syngas with carbonaceous fuels such as coal/biomass and natural gas. The OSU chemical looping reforming process uses an iron-based oxygen carrier (OC) in a co-current moving bed reactor for syngas generation. The OC circulates between two reactors, a reducer and oxidizer, allowing for the continuous production of syngas and regeneration of the OC, respectively. The present paper discusses the reaction mechanism for CO₂ reforming with the OC and reducing fuel, process simulation studies for the integration of chemical looping reforming process with gas-to-liquid plant, and experimental studies conducted at the bench and 15 kW_{th} sub-pilot scale. This presentation will focus on the theoretical thermodynamic rationale and validating experimental results for using a co-current moving bed reducer and an optimized iron-based OC particle.