

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The effect of stage number of plasma reactors on the combined steam reforming and partial oxidation of CO₂-containing natural gas was investigated by using non-thermal multistage gliding arc discharge under two experimental conditions at a constant feed flow rate (varying residence time with stage number) and a constant residence time (varying total feed flow rate with stage number). The major products were mainly hydrogen and carbon monoxide (synthesis gas). From the experimental results, the stage number of plasma reactors more affected the reactant conversions, product yields, and product selectivities than constant residence time. Moreover, the hydrocarbons (HCs)/O₂ feed molar ratio and input voltage significantly affected the reactant conversions, product yields, and product selectivities. Under the operating conditions of a HCs/O₂ feed molar ratio of 2/1, an applied voltage of 14.5 kV, an input frequency of 300 Hz, and an electrode gap distance of 6 mm, the plasma system operated with 3 stages of plasma reactors led to the good process performance with acceptably high reactant conversions, high desired product yields, and low power consumptions, i.e. 3.49×10^{-17} Ws per molecule of reactants converted and 2.04×10^{-17} Ws per molecule of hydrogen produced, at a residence time and a feed flow rate of 4.11 s and 100 cm³/min, respectively.

5.2 Recommendations

The effect of catalyst should be investigated in a gliding arc system or a multistage gliding arc discharge system. The position to place a catalyst should also be studied.