CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The combined reforming and partial oxidation of CO_2-containing natural gas was investigated under two series of system with a constant feed flow rate and a constant residence time by using non-thermal multistage gliding arc discharge. The major products were mainly hydrogen and C_2 hydrocarbons. In the case of the system without partial oxidation operated at a fixed flow rate, all reactant conversions, except CO_2 conversion, as well as product yields and product selectivities, increased with increasing stage number of plasma reactors. This is because when increasing stage number of plasma reactors, the reactants had longer residence time to collide with highly energetic electrons. For the system operated at a fixed residence time, the stage number of plasma reactors slightly affected the reactant conversions, product yields, and product selectivities because the reaction time of each stage number was the same, thereby resulting in the similar possibility of the reactants to collide with the highly energetic electrons. In the case of the system with partial oxidation, the number of plasma reactors provided the positive effects on the reactant conversions, product yields, and product selectivities, and also lower power consumption was consumed as compared with the system without partial oxidation. These can suggest that the oxygen molecules could be activated by the plasma and provide the oxygen active species for extracting the H atom from the hydrocarbons via oxidative dehydrogenation, resulting in higher reactant conversions, desired product yields, and selectivities. The addition of air as oxygen source provided the better process performance for the CO_2-containing natural gas reforming than that of pure oxygen. Moreover, 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.

5.2 Recommendations

The natural gas reforming should be studied by using the gliding arc discharge system with a catalyst to produce more hydrogen and higher hydrocarbons. Moreover, other reactions, including steam reforming of natural gas and combined steam reforming and partial oxidation of natural gas, should be investigated both without and with a catalyst.