CHAPTER V
CONCLUSIONS AND RECOMMENDAIONS

5.1 Conclusions

In the AC gliding arc discharge system used in this research, an appropriate amount of O_2 added to the simulated natural gas containing a high CO_2 content increased the number of oxygen-active species, leading to the increase in reactant conversions, product yields, and product selectivities, particularly in an oxygen-rich feed system. Moreover, the applied voltage, input frequency, and electrode gap distance significantly affected the reactant conversions, product selectivities, and product yields for the reforming of the simulated natural gas, mainly due to the alteration of electric field characteristics within the discharge zone. The optimum conditions were found at a HCs/O_2 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 7 mm, providing high CH_4 and O_2 conversions with high synthesis gas selectivity and very low power consumptions. Under these optimum conditions, the power consumptions were as low as 2.04×10^{-18} Ws (12.72 eV) per molecule of converted reactant and 1.43×10^{-18} Ws (8.93 eV) per molecule of produced hydrogen.

5.2 Recommendations

The recommendations for future work are as follows:

1. The effect of stage number (number of plasma reactors) should be investigated to optimize the process performance.
2. Various catalyst types are recommended to test under both the conventional gliding arc reactor and the gliding arc microreactor with and without partial oxidation.
3. To clearly understand the gliding arc characteristics, a high voltage probe should be used to measure the electrical parameters at high voltage side instead of low voltage side.

4. To study the plasma reaction mechanisms and kinetics, the optical emission spectroscopy (OES) should be used to detect radical species formed during the reactions.