CHAPTER V
CONCLUSIONS AND RECOMMEDATIONS

5.1 Conclusions

The partial oxidation of methane using an AC electric discharge demonstrated another feasible means of activating methane to produce synthesis gas. The reactions are achieved by the collision between high energetic electrons released from the metal electrode and both of methane and air molecules inside discharge gap to form higher hydrocarbon species and synthesis gas. From the experimental results, conclusions are drawn as follows:

1. Methane and oxygen conversions, yields of hydrogen and carbon monoxide, and current increased significantly with increasing applied voltage. Selectivity of synthesis gas (hydrogen and carbon monoxide) increased significantly with increasing applied voltage.
2. Methane and oxygen conversions, yields of hydrogen and carbon monoxide, and current decreased significantly with increasing frequency from 300 Hz because of a lower number of electrons available for initiating the reactions.
3. Methane and oxygen conversions as well as yields of hydrogen and carbon monoxide, decreased significantly with increasing methane partial pressure. The selectivity of hydrogen increased drastically with increasing methane partial pressure because there was a higher probability of electrons and ions to break the C-H bond of methane molecules and highly reacts to form C_2, conversely with those of CO and CO_2. However, the current was approximately constant with increasing methane partial pressure.

4. Methane and oxygen conversions, as well as yields of hydrogen and carbon monoxide, decreased slightly with increasing the flow rate or decreasing the reaction residence time because the probability that methane and air molecules had adequate time to come in contact with any electrons of sufficient energy to initiate the reactions, also decreased, thus resulting in lower selectivities of synthesis gas and C_2 species.
5. Methane and oxygen conversions increased slightly whereas yields of hydrogen and carbon monoxide decreased with increasing gap width. The current also decreased with increasing the gap width.
6. For methane/ethane/air system, the methane, ethane and oxygen conversions, as well as yields of hydrogen and carbon monoxide, increased with increasing applied voltage. The selectivity of C_2H_4 decreased with increasing applied voltage.
7. For methane/ethane/air system, the methane, ethane and oxygen conversions, as well as yields of hydrogen and carbon monoxide, decreased with increasing frequency. The selectivities of hydrogen and carbon monoxide decreased, but that of C_2H_4 increased with increasing frequency.
8. The presence of ethane in the feed containing methane and air enhanced the selectivities of hydrogen and ethylene.

5.2 Recommendations

It is very interesting in applying catalysts to the plasma reactor in order to enhance methane conversion.