CHAPTER V

CONCLUSIONS AND SUGGESTION

5.1. Conclusions

The following were the conclusions drawn from this investigation.

1. The reaction rate of methane steam reforming on nickel magnesia solid solution catalyst in case of steam excess could be expressed in first order of methane. The rate equation was as follows:

$$-r_{CH4} = k\ P_{CH4}$$

Where $k = 7.796 \times 10^{4} \exp(-18{,}726.78 / RT)$ mole $atm^{-1}\ kg^{-1}\ min^{-1}$

2. The reaction rate of methane steam reforming on nickel magnesia solid solution catalyst in case of steam non-excess could be expressed in order of 1 for methane and 0.5 for steam. The rate equation was as follows:

$$-r_{CH4} = k\ P_{CH4}\ P_{H2O}^{0.5}$$

Where $k = 2.2812 \exp(-9{,}041.16 / RT)$ mole $atm^{-i.5}\ kg^{-i}\ min^{-i}$

3. Not only methane conversion increased with increasing temperature, steam-methane ratio and catalyst weight, but also increased with decreasing methane and steam feed rate.

4. The methane steam reforming was the reaction giving first order, which was consistent with the Langmuir-Hinshelwood model.

5. From the experiment found that the value of Φ was considerably smaller than unity indicated that the chemical reaction was controlling step of reaction rate with the criteria of Weisz and Prater.

6. The trend of product gas composition was consistent with thermodynamics equilibrium then the thermodynamics model of reaction could be suggested in two reactions as follows:

$$CH_4 + H_2O \rightleftharpoons CO + 3H_2$$

$$CO + H_2O \rightleftharpoons CO_2 + H_2$$

5.2. Suggestion

Use as a preliminary data for the experiment with the fluidized bed reactor in the future to determine the optimum condition for the manufacture of synthesis gas at high hydrogen-carbon monoxide ratio and also obtaining better other results.