

## CHAPTER V

### CONCLUSION AND RECOMMENDATIONS

This research studied about hydrogen production by autothermal system and the oxidation of iso-octane was studied as well. NiCe/Al<sub>2</sub>O<sub>3</sub> and NiCr/Al<sub>2</sub>O<sub>3</sub> are used in the reaction, which is fed iso-octane as feedstock. The effects of temperature, oxygen ratio and steam ratio were investigated in this study.

The catalytic oxidation of iso-octane on Ni-Cr/Al<sub>2</sub>O<sub>3</sub> and Ni-Ce Al<sub>2</sub>O<sub>3</sub> was studied as a part of the study of the autothermal reforming of iso-octane in which exothermic and endothermic steam reforming reaction are combined. The results show that the ratio of O<sub>2</sub> /C in the feed has a strong influence on the light off temperature. The optimum oxygen ratio of Ni-Cr/Al<sub>2</sub>O<sub>3</sub> and Ni-Ce/Al<sub>2</sub>O<sub>3</sub> catalyst, was 0.5. The oxidation study shows a non-monotonic dependence on oxygen pressure with the order with respect to oxygen varying from positive to negative, depending on oxygen partial pressure.

The effect of cerium and chromium addition in catalyst was observed by catalyst characterization. From TPR result shows that Ni-Cr catalyst is easier to reduce than Ni-Ce at the low temperature region. At temperature above 600°C Ni-Ce catalyst was be reduced more than Ni-Cr catalyst. This was confirmed by the comparison of light off temperature of Ni-Cr/Al<sub>2</sub>O<sub>3</sub> and Ni-Ce/Al<sub>2</sub>O<sub>3</sub> catalyst. It is observed that Ni-Cr catalyst has the lower light off temperature than that of Ni-Ce catalyst. However at high temperature. the higher conversion of iso-octane was obtained from Ni-Ce catalyst.

For the autothermal reforming studies, The Ni-Cr and Ni-Ce catalysts were found to perform very well during steam reforming of iso-octane with autothermal system. For Ni-Ce catalyst, The H<sub>2</sub>/CO ratios were slightly effected by increasing oxygen concentrations. This indicated that ceria acts as

the oxygen storage. Moreover, the  $H_2/CO$  ratio of the products was substantially dependent on the steam/carbon in Ni-Ce catalyst reaction. For the reactions carried on  $NiCr/Al_2O_3$ , both of steam/carbon and oxygen/carbon ratios have strong effects on the  $H_2/CO$  ratio. It was observed that the optimum  $O_2/C$  ratio and  $H_2O/C$  ratio are 0.5 and 2, respectively.

Ce and Cr would be excellent promoters of steam reforming catalyst with autothermal system because not only they promote the autothermal reaction but also prevent and reduce the coke formation.