



## CHAPTER V

### CONCLUSION AND RECOMMENDATIONS

Hydrogen production by autothermal system over Ce/Zr mixed oxides was investigated in this study. Ce/Zr mixed oxides were prepared by urea hydrolysis. The effect of Ce:Zr molar ratios, urea concentrations, drying methods and Ni loading were investigated on the catalytic properties of Ce/Zr mixed oxides. It was observed that the addition of ZrO<sub>2</sub> in CeO<sub>2</sub> lattice increases the thermal stability of CeO<sub>2</sub>, resulting in better resistance to sintering. Although Ce<sub>1-x</sub>Zr<sub>x</sub>O<sub>2</sub> (x = 0.25, 0.50 and 0.75) was calcined at high temperature, the surface area of Ce<sub>1-x</sub>Zr<sub>x</sub>O<sub>2</sub> was higher than CeO<sub>2</sub>. Urea concentration hardly influences on the properties of Ce<sub>0.75</sub>Zr<sub>0.25</sub>O<sub>2</sub>. Ce<sub>0.75</sub>Zr<sub>0.25</sub>O<sub>2</sub>s prepared with different urea concentrations have similar properties, whereas Ce<sub>0.75</sub>Zr<sub>0.25</sub>O<sub>2</sub> dried under supercritical conditions has bigger pore sizes and higher pore volumes than Ce<sub>0.75</sub>Zr<sub>0.25</sub>O<sub>2</sub> dried by conventional method (100°C). The presence of CeO<sub>2</sub>-ZrO<sub>2</sub> solid solution is observed in Ce/Zr mixed oxides, especially in Ce<sub>0.75</sub>Zr<sub>0.25</sub>O<sub>2</sub>.

Ce/Zr mixed oxides were tested the catalytic activity by iso-octane oxidation at O<sub>2</sub>/C of 1. It was found that Ce<sub>0.75</sub>Zr<sub>0.25</sub>O<sub>2</sub> with reaction time 120 hours and calcined at 500°C exhibited the highest catalytic activity for iso-octane oxidation. In the study of the effect of O<sub>2</sub>/C on light off temperature, 5%Ni/Ce<sub>0.75</sub>Zr<sub>0.25</sub>O<sub>2</sub> gave the highest catalytic activity at the O<sub>2</sub>/C of unity. For the autothermal system study, 5%Ni/Ce<sub>0.75</sub>Zr<sub>0.25</sub>O<sub>2</sub> was found to performed very well in autothermal system. H<sub>2</sub>/CO product ratio was influenced by increasing steam concentration. In addition, H<sub>2</sub>/CO product ratio was slightly affected by a rise in O<sub>2</sub>/C. It is suggesting that ceria acts as the oxygen storage.

5%Ni/Ce<sub>0.75</sub>Zr<sub>0.25</sub>O<sub>2</sub> would be a good catalyst for hydrogen production from iso-octane by autothermal system. It not only enhances the autothermal reaction but also reduce the coke formation.