CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The effects of oxygen addition on the CO_2 reforming of CH_4 reaction and effects of cerium addition in the catalyst were investigated in this work. Pt/ZrO_2 and $Pt/Ce\text{-}ZrO_2$ catalysts were used in the reaction. The CH_4:CO_2 ratio of two and total flow rate of 150 ml/min were used to investigate the activity and stability of the catalyst. The loss of catalyst activity at 800 °C was monitored for approximately 15 hours.

The experimental results achieved indicated that oxygen concentration had a strong effect on the catalyst activity and stability. Cerium loading also affected the catalyst activity but to a lesser extent. The increase in oxygen concentration led to an increase in activity and stability of the catalyst for the CO_2 reforming. It could be postulated that oxygen had some roles in promoting the cleaning mechanism. The added oxygen could react with carbon deposited on the metal particles or dissociated to give adsorbed oxygen, which accelerated CH_4 decomposition reaction. In addition, CH_4 could react with oxygen in methane combustion towards CO_2 and H_2O, which could act as reactants in CO_2 reforming and steam reforming of methane, leading to higher catalyst activity. Moreover, steam could also help the cleaning mechanism by reacting with carbon deposited on the metal particle, resulted in higher catalyst stability.

The addition of cerium in the catalyst increased the catalyst activity as the amount of cerium concentration increased by stabilizing the tetragonal form of the ZrO_2. However, there was an optimum loading of both cerium and oxygen. The optimum oxygen concentration was 7%, and at this concentration

Pt/7%Ce-ZrO_2 was the most active catalyst. Moreover, oxygen concentration and cerium loading had little effect on the H_2:CO (0.80-1.30).

5.2 Recommendations

Addition of steam to the CO_2 reforming should also be investigated. It is recommended that further study should focus on using steam as the promoter. In addition, other promoters such as yttrium, could be used instead of cerium because it has been reported that yttrium can improve catalyst properties and oxygen capacity storage in automotive catalysts.