CHAPTER V
CONCLUSIONS AND RECCOMMENDATIONS

5.1 Conclusions

The reaction conditions, catalyst preparation and the addition of promoter greatly affected catalytic activity and stability of Pt/ZrO_2 catalysts for dry reforming reaction. The study on the effect of CH_4:CO_2 ratio and GHSV was found that the net carbon deposition increased with increasing the CH_4:CO_2 ratio, while increasing GHSV resulted in a decrease in contact time between catalyst and reactant gases.

The addition of Ce and Y as promoters improved catalyst properties by increasing the surface area by stabilizing the tetragonal form of zirconia, and increasing the stability of catalyst by enhancing carbon cleaning ability. Comparison between Ce- and Y-promoted catalysts showed that Y-promoted catalysts had higher ability to anchor high surface area of zirconia, so their surface areas were higher than Ce-promoted catalysts. The activity of Y-promoted catalysts were also higher than Ce-promoted catalysts, however, the results from H_2/CO product ratio indicated that Y-promoted catalysts had higher trend to produce water via reverse water gas shift reaction than Ce-promoted catalysts.

The study on the effect of mixed-promoter showed that, although the mixed-promoter catalyst had lower conversion, but it had higher promoter loading capacity and higher stability than pure promoted catalyst.

The promoter loading capacity of impregnation catalyst had the limitation. Too high amounts of promoter resulted in pore blocking effect and suppressed ability of Pt loading. Co-precipitation was postulated to impose no effect of pore blocking when promoter concentration was less than 30%, but at

higher concentration, this effect could not be ruled out. Calcination temperature greatly affected the crystallographic form of zirconia prepared by co-precipitation technique. The co-precipitation catalyst calcination at 600°C gave significantly better characteristics than that calcination at 800°C. Compared with impregnation catalyst, co-precipitation catalyst yielded higher surface area, activity, and stability.

5.2 Recommendations

The catalyst preparation technique and the addition of promoter greatly affected the activity and stability of Pt/ZrO_2 catalyst. Sol-gel technique is recommended for further studies. Recent studies have shown that sol-gel technique produces a high surface area, high purity, and homogeneous phase catalysts. Other interesting promoters are La_2O_3 and PrO_x, which have been reported to have oxygen storage capacity. Moreover, addition of water, or oxygen, which can compete effectively with carbon dioxide to react with methane, are worth investigating, as this can lead to a more efficient catalytic reaction system, that will ultimately solve the problem of catalyst deactivation.