



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In this research work, a series of Au-based catalyst (Au/La-CeO_x) has been used to catalyze the preferential CO oxidation reaction (PROX) in the presence of H₂ over a range of operating temperature of 60–180°C. Several parameters on the catalytic behavior were investigated; including the effect of support preparation method, drying method, content of gold Au loading, calcination temperature, and the effect of O₂ pretreatment; in order to find the optimum preparation conditions to produce the finest Au/La-CeO_x catalyst. In addition, the catalytic behavior of the best Au/La-CeO_x catalyst was then studied under the realistic reformat gas stream, which contained CO₂ and H₂O.

From the result, the NH₄OH precipitation was considered to be the favorable support preparation method, which provided a highest surface area leading to the highest catalytic behavior in the optimum condition for PEMFC application (~100–140°C). Furthermore, the freeze dried Au/La-CeO_x catalyst exhibited a higher CO conversion and PROX selectivity when compared to that of the oven dried Au/La-CeO_x catalyst. The reason behind this fact is that the freeze drying method created a catalyst with better gold dispersion on the support, as also confirmed by TPR and TEM characterizations.

The catalytic activities of the Au/La-CeO_x catalyst also depended on the amount of gold content and the calcination temperature of the catalyst. The catalyst with the 1%wt Au loading and calcination temperature of 400°C gave the highest Co conversion of 90.9% and PROX selectivity of 40.3%, owing to the smaller size of Au particles on the support. But, when O₂ pretreatment was applied to the catalyst, the CO conversion and PROX selectivity increased to 95.6% and 40.8%, respectively.

The Au/La-CeO_x catalyst showed a good result in stability test for 19 hours and the catalyst was able to stand the presence of water up to 10% in the feed stream without any decrease in the catalytic activity. However, when CO₂ (10%) was injected in the feed stream, the catalyst activity was negatively affected.

5.2 Recommendations

The catalysts are recommended to be prepared in the same batch in order to prevent any error that may occur, as the catalytic performance is sensitive to many import factors.

The oxidation state of gold presented on the catalyst surface and catalytic performance is the important parameter which can determine the catalytic performance of the catalyst. Therefore the X-ray photoelectron spectroscopy (XPS) is recommended for further characterization, in order to explain the role of the oxidation state of Au on the catalytic behavior.

To accomplish 100% CO conversion and higher PROX selectivity, the bi-metallic containing Au and Pt over La-CeO_x might be interesting.