CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In this work, a series of Au-based catalyst (Au/FeO_x-MnO_x) has been investigated on both simulated reformate and realistic reformate gas stream. The catalytic performance was primary studied in the preferential oxidation (PROX) of CO in a H_2-rich stream as a simulated reformate gas stream. Methanol fuel processor was then developed to supply as a realistic reformate gas stream over the Au/FeO_x-MnO_x catalyst. Many parameters were studied on the catalytic behavior in PROX of CO at a operating temperature range of 60–180°C. Interestingly, the increasing Au loading on the composited oxide support (Fe-Mn) exhibited a significant impact on the catalytic activity. Addition of Au content on composited oxide support could reduce the peak reduction temperature of catalyst (TPR). Moreover, an addition of Au resulted in a significant increase the surface area of the prepared catalyst, possibly due to decreasing crystal size of Fe-Mn oxide.

However, one of an important factor is type of support since the different supports result in different catalytic activity. The result showed that the remarkably higher reducibility exhibited higher catalytic activity. Among the catalysts tested on the catalyst with a Au/FeO_x-MnO_x atomic ratio of 1/30 exhibited the highest performance.

The catalyst calcined at 400°C gave the highest catalytic activity attributed to higher reducibility of the prepared catalyst.

For deactivation of Au/FeO_x-MnO_x(1:1) atomic ratio of 1/30, a Fe/Mn molar ratio of 1/1 calcined 400°C did not only showed a good activity in the presence of water vapor (10%) in the feedstream but also increased the CO conversion while the negative effect on catalytic activity was strongly clarified in the presence of CO_2 (10%) in the feedstream.

Nevertheless, this catalyst was operated in a realistic reformate gas by using an MFP and it exhibited a good performance and high CO conversion up to 80% at 60°C during the tested time (12 hours).

5.2 Recommendations

There are many important factors affecting to the catalytic performance. One of a primary factor is the catalyst preparation; therefore the catalyst should be prepared in the same batch.

The most interesting issue in this area is oxidation state of Au. The relationship between the oxidation state of gold presented on the catalyst surface and catalytic performance using the X-ray photoelectron spectroscopy (XPS) should be investigated.

Although the Au/FeO_x-MnO_x prepared by deposition precipitation technique showed a good catalytic performance on an MFP, the development of this MFP is required for being applied to an onboard fuel processor due to lower temperature operation and catalytic activity.