



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Au supported catalyst has been studied to produce hydrogen from the steam reforming of methanol reaction. Au/CeO₂, Au/Fe₂O₃, and Au/Fe₂O₃-CeO₂ were chosen to study the performance in this reaction. Several parameters that influence the catalytic activity of the catalyst, which are the type of support, mole ratio of support, calcinations temperature, Au content, catalyst pretreatment, and reaction temperature. 1%Au/Fe₂O₃-CeO₂ was chosen to study further in the decomposition of methanol and the water gas shift reaction. Moreover, the catalyst was performed for 24 hours of reaction time to study the deactivation of the catalyst. In the case of the calcination temperature, the catalyst calcined at 400°C seemed to be the suitable calcination temperature, because it gave the highest catalytic activity. The Au content is the one of important parameters that affects the catalytic activity. From the experiment, the 1%Au catalyst gave the highest catalytic activity, compared to 3% and 5% atom. The higher Au content will make the Au particle become bigger or agglomeration. The Au particle size less than 5 nm seemed to be the appropriate size for this reaction. The Au catalyst play an important role in the reaction because only the support did not show any activity at low temperature. However, type of support also has an important factor because the different support will exhibit different catalytic activity. The results showed that the 1%Au/Fe₂O₃-CeO₂(1:8) gave 100% methanol conversion and 74% hydrogen selectivity at 450°C. Among the catalysts tested 1%Au/CeO₂, 1%Au/Fe₂O₃-CeO₂(1:8), and 1%Au/Fe₂O₃ the 1%Au/Fe₂O₃-CeO₂(1:8) exhibited the highest performance. This is due to the cooperation between Fe₂O₃ and CeO₂, which influences the surface area and reduction temperature of the catalyst. For deactivation testing, the 1%Au/Fe₂O₃-CeO₂(1:8) shows only slightly decreased of the methanol conversion when the catalyst was tested in the methanol steam reforming for 24 hours. For sides reaction ; the decomposition of methanol and water gas shift, the 1%Au/Fe₂O₃-CeO₂(1:8) gave the methanol conversion about 60% and carbon monoxide conversion about 65%.

5.2 Recommendations

The consistent preparing catalysts seemed to be a significantly factor that will affect the catalytic activity. Thus, the catalyst should be prepared in the same batch.

The oxidation state of Au is very interesting because there are many parameters which affect the oxidation state of Au. X-ray photoelectron spectroscopy (XPS) is recommended to characterize the catalyst, in order to explain the chemical state of gold that presents on the surface of catalyst and determine the relationship between states of gold and catalytic performance.

To lower the temperature of the reaction, the Oxidative Steam Reforming of methanol over the Sn support is recommended, which is active for this reaction.