CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The catalytic performance for the selective CO oxidation of the 1%Pt/LTA-zeolite had been studied in this work. The different types of supports were used, including synthesized LTA (abbreviated LTA4), commercial LTA (abbreviated LTA6) and γ-Al_2O_3 (abbreviated Al_2O_3) which is used in conventional Pt/ γ-Al_2O_3 catalyst for this reaction, to study the effect of the support for this reaction. The effect of CO_2 concentration, H_2O concentration and the combination of CO_2 and H_2O were also investigated. Moreover, we also promoted the 1%Pt/LTA6 catalyst with Fe to study the effect of Fe on the catalytic performance of the catalyst. All results that had been found in this work lead us to the conclusion as follows:

Both 1%Pt/LTA4 and 1%Pt/LTA6 catalysts show a good performance on the selective CO oxidation reaction. They have a better catalytic activity than the conventional 1%Pt/Al_2O_3 catalyst, both in terms of CO conversion and CO selectivity. Regarding to the CO conversion, the 1%Pt/LTA4 and 1%Pt/LTA6 can nearly completely remove CO from the H_2-rich stream. On the other hand, the 1%Pt/Al_2O_3 gave only about 85% CO conversion. For the CO selectivity, using LTA zeolite as the catalyst support can dramatically improve the CO selectivity comparing to the conventional Pt/Al_2O_3 catalyst, particularly at low temperatures. This may be a result of molecular sieve property of the LTA zeolite support. Since the pore diameter of the LTA zeolite (4A) is close to the size of the CO and O_2 molecule, while, it is much larger than the size of H_2. Consequently, it is harder for the CO and O_2 molecules to diffuse through the pore opening into the cavity compared to the H_2. Thus, H_2 molecules have less chance to access the Pt active site than the CO and O_2. On the other hand, it gave more change to the CO and O_2 to reach the Pt active size and this make the CO selectivity of the catalyst increase.

The source of LTA zeolite support has affected on the catalytic performance of the catalyst. The 1%Pt/LTA4 and 1%Pt/LTA6 provide different CO conversion profiles, in terms of maximum CO conversion temperature, and CO

selectivity profile, particularly at low temperatures. The causes of this are not quite clear. However, there are many possibilities that may be explained for these. For example, the differences may come from the different morphology between LTA4 and LTA6 or come from different unknown electronic property between LTA4 and LTA6 which leads to different Pt particle size on the support.

The CO_2 has slightly positive effect on the catalytic performance of both 1%Pt/LTA4 and 1%Pt/LTA6. The cause of this phenomenon is still not understood as well.

The H_2O has significantly negative effect on the catalytic performance of both 1%Pt/LTA4 and 1%Pt/LTA6. The H_2O molecules might occupy inside the pore of the LTA, which will take away the sieving capability of the LTA support, as a consequence, the catalytic performance of the 1%Pt/LTA catalyst was reduced.

The combination of the CO_2 and H_2O showed the effect on the catalytic performance of the 1%Pt/LTA catalyst between the effect of CO_2 and H_2O, however, the H_2O seemed to have slightly more effect than the CO_2. This suggests the importance of the sieving capability of the LTA support on the performance of the catalyst.

The 1%Pt/LTA6 catalyst has a good stability. No deactivation activity was observed during 12 hrs long time on stream of the catalyst, suggesting that there are no sintering or coke occurrence on the catalyst during the reaction performing.

5.2 Recommendations

Since there are still many points in this work that is not clear, such as the cause of different catalyst performance between 1%Pt/LTA4 and 1%Pt/LTA6, therefore, in-situ characterization is recommended to be performed to observe the intermediates which occur on the catalysts. This will lead to understanding of the mechanism of reaction on the 1%Pt/LTA catalysts.