CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The BET surface area of 0.12% Au/ Y_2O_3 decreased when calcination temperature increased from 300°C to 400°C. However, beyond 500°C, the BET surface area increased. The phase transfer obtained from XRD and TGA was studied to explain these unusual results. At 200-300°C, yttrium nitrate hydroxide hydrate ($Y_6(NO_3)_8O(OH)_8 \cdot 16H_2O$), the precursor of yttrium oxide, was transformed to yttrium hydroxide ($Y(OH)_3$). At 300-400°C, yttrium hydroxide lost water and became yttrium oxide hydroxide (YOOH), having the lowest surface area. At 400-700°C, yttrium oxide hydroxide was continuously being converted to yttrium oxide (Y_2O_3), having the highest surface area.

For carbon monoxide oxidation, gold supported on NiO gave a higher catalytic activity than that of Y_2O_3. The light-off temperatures of Au/NiO and Au/Y_2O_3 were 185 and 265°C respectively. The activation energy of Au/NiO, 7.241 kCal/mole, was lower than that of Au/Y_2O_3, 15.852 kCal/mole. In contrast with carbon monoxide oxidation, the catalytic activity of Au/Y_2O_3 was close to that of Au/NiO in methanol conversion, which was displayed in the light-off temperatures of 211°C and 206°C respectively. In addition, both catalysts gave complete conversion of methanol when the reaction temperature exceeded 250°C. It was also denoted that a by-product was detected at low reaction temperatures for both catalysts. When comparing the catalytic activities of 0.12% Au/Y_2O_3 in carbon monoxide and in methanol oxidations, it was found that the catalytic activity of 0.12 % Au/Y_2O_3 for methanol oxidation was higher than that of CO oxidation.

Furthermore it was denoted that yttrium oxide hydroxide (YOOH), calcined 400°C, displayed the highest catalytic activity in CO oxidation.

5.2 Recommendations

From the results, gold supported on yttrium oxide should be further studied for the catalytic activity at a wide gold loading range from zero to 100% in order to find the optimum value of gold loading. High molecular reactants, especially toluene and benzene which are normally used in petrochemical industry, should be studied. Moreover, the characterization not only of the particle size but also the dispersion of gold on yttrium oxide should be performed in order to correlate the catalytic activity with the particle size and with the dispersion of gold. The transmission electron microscope (TEM) at high level of magnitude which has been widely used to determine particle size and the dispersion of gold, is strongly recommended in the future study.