CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

This chapter is focused upon the conclusions of the experimental details of the influence of concentration of aluminum isopropoxide in 1-butanol used in the preparation of nanocrystalline alumina by solvothermal method on the properties of alumina powders and alumina supported-cobalt catalysts, the effect of mixed γ and χ crystalline phases in Al_2O_3 on the characteristics and catalytic activities of alumina-supported cobalt catalysts and the effect of Cu as an Al_2O_3-modifier on the characteristics and catalytic activities of alumina-supported iron catalysts during FTS reaction which was described in section 6.1. In addition, Recommendations for further study are given in section 6.2.

6.1 Conclusions

6.1.1 The influence of concentration of aluminum isopropoxide in 1-butanol used in the preparation of nanocrystalline alumina by solvothermal method on the properties of alumina powders and alumina supported-cobalt catalysts during CO hydrogenation reaction

Nanocrystalline alumina powders were prepared by thermal decomposition of AIP in 1-butanol with various AIP contents. The concentration of AIP in 1-butanol had a significant impact on the properties of alumina and alumina supported cobalt catalysts. Increasing amounts of AIP in the solution resulted in the transformation of wrinkled sheet γ-alumina to fine spherical particles of χ-alumina. It also gave rise to the cobalt active sites and CO hydrogenation activities when employed as supports for preparation of Co/Al_2O_3 catalysts.

6.1.2 The effect of mixed γ and χ crystalline phases in Al_2O_3 on the characteristics and catalytic activities of alumina-supported cobalt catalysts during CO hydrogenation reaction

Nanocrystalline γ-Al_2O_3 and mixed γ- and χ-Al_2O_3 were obtained by decomposition of AIP in 1-butanol by varying the amounts of AIP used under the solvothermal conditions. For a similar Co loading, the presence of χ-phase in γ-Al_2O_3 support resulted in higher dispersion of Co as well as higher CO hydrogenation activities of the Co/Al_2O_3 catalysts. It is suggested that the spherical-shape like morphology of the χ-phase Al_2O_3 provide better stability of the Co particles, especially for those with high Co loadings.

6.1.3 The effect of Cu as an Al_2O_3-modifier on the characteristics and catalytic activities of alumina-supported iron catalysts during FTS reaction

It was found that the Fe catalysts supported on Cu-modified alumina exhibited much higher activities than those of the 1% Cu-promoted Fe/Al_2O_3 catalyst. There was little effect on FT product selectivity, chain growth probability (α), or olefin selectivity. Moreover, calcination after impregnation of each metal during catalyst preparation is an important step in achieving highly active catalysts.

6.2 Recommendations

1. Effect of the mixed-phases alumina supports on an increase of catalytic activity at high cobalt loading for the Co catalysts should be further investigated.

2. Effect of Cu-modification of alumina supports on the nature of the Fe (particle size, composition in terms of various Fe species, reducibility) should be further investigated.