

## CHAPTER VI

### CONCLUSIONS AND RECOMMENDATION

This chapter is focused upon the conclusions of the experimental details of the characteristics and catalytic properties of crystallite sizes of  $\text{TiO}_2$ , properties of 20 wt% of  $\text{Co/TiO}_2$  catalysts and various cobalt dispersion of  $\text{Co/TiO}_2$  catalysts 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 crystallite sizes of titanium (IV) oxide (titania)*

The nano- $\text{TiO}_2$  powders were synthesized by solvothermal method under various reaction conditions in order to obtain the average crystallite sizes of 9-15 nm. The amounts of surface defect of  $\text{TiO}_2$  were measured by means of temperature programmed desorption of  $\text{CO}_2$  and electron spin resonance spectroscopy. It was found that the ratios of surface defect/specific surface area increased significantly with increasing  $\text{TiO}_2$  crystallite size. The  $\text{TiO}_2$  with higher amount of surface defects exhibited much higher photocatalytic activity for ethylene decomposition.

##### *6.1.2 crystallite sizes of titania on 20 wt% $\text{Co/TiO}_2$ catalysts*

The nanocrystalline  $\text{TiO}_2$  powders with average crystallite sizes of 9-15 nm were synthesized by solvothermal method and employed as supports for Co catalysts. The amount of  $\text{H}_2$  chemisorption/specific surface area of  $\text{Co/TiO}_2$  increased significantly with increasing  $\text{TiO}_2$  crystallite size. It was suggested that the higher amount of  $\text{Ti}^{3+}$  surface defects on the larger crystalline  $\text{TiO}_2$  resulted in stronger interaction between Co and  $\text{TiO}_2$ , hence, higher dispersion of Co was obtained.

### 6.1.3 Effect of $\text{TiO}_2$ crystallite size on various Co loading of $\text{Co/TiO}_2$ catalysts

The results of the effect of crystallite size of titania on percent cobalt loading. The catalysts were characterized by X-ray diffraction (XRD), BET surface area, scanning electron microscopy (SEM), and  $\text{H}_2$  chemisorptions. Co loading from 5 to 20 wt% for the two crystallite size of titania (9 and 15 nm),  $\text{TiO}_2$ -supported Co catalysts. It was found that the relationship between amount of  $\text{H}_2$  chemisorption/BET and percent weight cobalt loading were Co dispersion increased up to 10 wt% Co and declined at 20 wt% Co loading and CO conversion increased when crystallite size increased.

## 6.2 Recommendations

6.2.1 Effect of crystallite size of titania supports mixed with other inorganic oxides should be further investigated in modify surface defect.

6.2.2 Effect of crystallite size of titania supports should be further investigated, for other metal and wt. % catalysts or second metal on  $\text{Co/TiO}_2$  such as platinum.

6.2.3 Try to use another condition (TNB; g, Temp. or holding time) to prepare titania for create smaller titania.

6.2.4 Use another titanium as start material instead titanium (IV) *n*-butoxide (TNB) for investigation surface defect.

6.2.5 Use another solvent for prepare crystallite size of titania catalysts.

6.2.6 Add impurity solvent before preparation titania by solvothermal (Extrinsic defects).

6.2.7 Use another method for preparation  $\text{Co/TiO}_2$ .