

## CHAPTER V

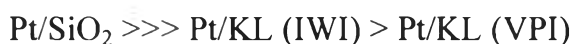
### CONCLUSION AND RECOMMENDATIONS

The kinetic results can be examined by using the method of fixing one of reactant flow rate and varying the other. The difference in the activation energy indicated different reaction paths and/or differences in the chemical state of the metal. However, the true activation energy can be obscured by the heats of adsorption. Therefore, the activation energy obtained from kinetic data is the apparent activation energy which depends on partial pressure of the reactants.

The nonporous Pt/SiO<sub>2</sub> gave the highest n-butane conversion. This indicated that hydrogenolysis is less active on the microporous material, *i.e.*, the catalyst supported on KL zeolite. This idea was supported by the effect of preparation methods. The Pt/KL prepared by IWI, which left some platinum particles outside the channels of the zeolite, gave a higher n-butane conversion than that of the Pt/KL prepared by VPI.

The formation of 2,3-diadsorbed n-butane was proposed as an intermediate mechanism of the reactions (See Figure 4.5). The VPI sample, having the most uniform and smallest platinum particles inside the channels of the zeolite, showed the highest ethane to methane molar ratio, and thus resulting in the highest probability of the formation of 2,3-diadsorbed n-butane. The promoted samples showed higher ethane to methane molar ratio than that of the unpromoted sample. The explanation is that the promoters promoted the formation of 2,3-diadsorbed n-butane. The connection between the isomerization of n-butane and the central carbon-carbon bond fission is the 2,3-diadsorption mechanism (Bond, 1997). Ce promoted the isomerization of n-butane and the above idea (the formation of 2,3-diadsorbed n-butane) fit nicely with this result.

The order of the isobutane selectivity is as follows:



The possible explanation is that the Pt(111) plane was the most stable thermodynamically and was selective for isomerization. And the lower the metal-support interactions, the higher the (111) facets in a catalyst. In other words, the metal acted as if it were active alone without any support. According to this idea, we can expect the following order of metal-support interactions:



The significant methane to propane molar ratio suggested whether the adsorbed hydrogenolysis products were further cracked or not. Since Pt/KL used in this thesis was monofunctional catalyst (metal catalyst), there were not many species on the surface. For deep hydrogenolysis, the main source of methane was the adsorbed C<sub>3</sub> species since the rate of hydrogenolysis of C<sub>3</sub> was much greater than that of C<sub>2</sub>. Therefore, the methane to propane molar ratio of unity meant that deep hydrogenolysis did not occur. And for the case that methane to propane molar ratio was more than unity, the further cracking of adsorbed C<sub>3</sub> species was expected. According to the results, the further cracking of adsorbed C<sub>3</sub> species occurred at only 400 °C, which was the highest temperature studied in this thesis work. Another conclusion is that the higher the temperature, the higher the probability of breaking the terminal carbon-carbon bonds.

In order to understand the mechanism of n-butane hydrogenolysis and n-butane isomerization better, the isotropic study is recommended for further study. The hydrogenolysis reaction on KL zeolite and Ce/KL in comparison with that on Pt/KL catalyst is suggested to study their direct effects.