



## CHAPTER 1

### INTRODUCTION

Propane dehydrogenation is an important reaction for producing propylene monomer. Most catalyst in this process is platinum based catalyst. However, the main problem for dehydrogenation process is the deactivation by coking on both metallic and acidic sites of the catalyst, thus activity, selectivity and life time of the catalyst are decreased.

Because of the good condition for dehydrogenation reaction, high temperature and low pressure, are the conditions that favor coke formation as well as propane dehydrogenation. Therefore, There are many studies trying to characterize coke on the catalyst and attempt to decrease coke deposition. The most popular method for reducing coke deposition is adding some metal such as tin, rhenium or some alkali metals to the catalyst.

Coke deposition is a complex reaction which resulted from the production of coke precursor and from their destruction. Coke on the catalyst can be divided into two types: one is coke on metallic function and the other is coke on acidic support (Barbier,1987). In addition, coke on metal sites of the catalyst can be further distinguished into two types, reversible coke and irreversible coke (Biswas et.al., 1987). Further more, successive dehydrogenation reaction induces reversible coke to

irreversible coke or more graphitic coke.

A number of researchers investigated the role of added metal or promoter on coke formation. Tin which used as the promoter of Pt/Al<sub>2</sub>O<sub>3</sub> can affect the properties of both metallic function and acidic function. For metallic function tin reduced the strength of chemisorption of the hydrocarbon (Lin Liwu et.al., 1991). Therefore, coke precursor can easily migrate to support. The other explanation of decreasing coke deposition on metallic function is ensemble effect, the segregation of platinum particle by tin to smaller particle.

The third metal added to bimetallic catalyst such as Pt-Sn/Al<sub>2</sub>O<sub>3</sub> usually be alkali metal. Alkali metal is added to reduce the acidity of the catalyst, thus reduces coke on acidic support. In addition, alkali metal can act as textural promoter which result in reducing coke on metal active sites more than Pt-Sn bimetallic catalyst (Siripoln, 1995).

However, the roles of tin and alkali metal especially potassium on low temperature coke on metal active site have never been studied although there were many studies about their effect on coke deposit on metallic function. Low temperature coke is defined as coke that can be burned by oxygen at low temperature i.e. less than 250 °C, while coke that burned by oxygen at higher temperature is named high temperature coke. Therefore, this study try to find out the role of tin and potassium on low temperature coke on metal active site for propane dehydrogenation. -

### Objective of the study

1. To define low temperature coke from temperature-programmed oxidation.
2. To study the synergistic effect of promoter( Sn and K ) for the dehydrogenation of propane.
3. To find out the role of promoter( Sn and K ) for low temperature coke on metal active site.



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