

CHAPTER I

INTRODUCTION



The conversion of paraffins to olefins is an important way to increase the chemical value of paraffins. The current methods for the olefin production are thermal cracking process and dehydrogenation process. Both processes are endothermic reactions which require very high temperature to shift the equilibrium forward. At this high reaction temperature, for thermal cracking process, it is difficult to control the direction of reaction and product distribution, while for dehydrogenation process, catalyst could control the direction of reaction. Moreover, coke which occurred on both processes at the high temperature would decrease the olefin production and interrupt the process system.

Many researchers attempted to solve these problems of the olefin production process. Interestingly, in thermodynamics, alkenes can be produced from the oxidation reaction between corresponding alkanes and oxygen. Because of the exothermic reaction, coke formation can be avoided though may not completely. In this process, only two hydrogen atoms are removed from a hydrocarbon molecule in the form of water without insertion of an oxygen atom into the hydrocarbon reactant. This oxidation reaction is called "Oxidative dehydrogenation (ODH)" or oxydehydrogenation to distinguish from partial oxidation.

Oxidative dehydrogenation, however, is a difficult to control oxidation reaction. In the nature of hydrocarbons, alkane is more inert than its respective alkene. Thus, any catalyst which can oxidize alkane can also activate alkene to react further with oxygen into combustion products such as carbonoxides and water.

Several oxide systems have been studied to find a suitable catalyst for the oxidative dehydrogenation. Among several systems investigated, vanadium supported on magnesium oxide (V-Mg-O) has received more attention than any others in the oxidative dehydrogenation, because a significant amount of alkene is produced without oxygenate formation.

Theoretically, the alkene which has π in its structure is usually more basic than its respective alkane. Therefore, the catalyst used in the oxidative dehydrogenation should be a basic catalyst for inhibiting the alkene readsorbed on catalyst surface reacts further into carbon oxide and water.

For this research, the V-Mg-O system is developed by adding alkali metal to modify the performance of the catalyst on propane oxidative dehydrogenation. Hence, this work was set up to investigate :

1. The effect of adding alkali metal during the preparation of V-Mg-O catalyst on propane oxidative dehydrogenation.
2. The relationship between the changed structure of V-Mg-O catalyst and their reactivity.
3. The effect of acid - base property of V-Mg-O catalyst with alkali metal on the oxidative dehydrogenation selectivity.

The present work is arranged as follows;

Chapter II presents literature reviews of investigation over oxide systems on the oxidative dehydrogenation.

In chapter III, the theory, studied about the oxidative dehydrogenation and its possible mechanism, the properties of V-Mg-O catalyst, are described.

The experimental systems and the operational procedure are presented in chapter IV.

Chapter V shows the experimental results of the characterization of catalysts and the propane oxidative dehydrogenation over V-Mg-O with the different alkali metals.

In the last chapter, the overall conclusion emerged from this work is presented.

Finally, the sample of calculation of catalyst preparation, reactant flow rates including explosive limit checking, the calibration curve of propane and propene, data of experiments and a published paper which has emerged from this study are included in appendix at the end of this thesis.