CHAPTER I

INTRODUCTION

Increasing attention has been focused on the utilization of cheaper feedstocks, such as alkanes in industrial chemistry. Light alkanes which are abundant in natural gas such as liquefied petroleum gas have been used to produce light alkenes (ethylene, propylene and butenes) [1-4]. The light alkenes are valuable materials which find increasing usage in the chemical industry, particularly plastic industry.

Generally, Pt/Al_2O_3 reforming catalysts have been used industrially to dehydrogenate propane (C_3) into propylene [5]. However it has some problems about the catalyst deactivation as a result of coke formation and platinum (Pt) is the very costly metal [6]. So there has been much recent interest in trying to find the catalysts which have the same or higher activity than Pt/Al_2O_3 and the life time of catalyst is longer than that of Pt/Al_2O_3 but the cost of catalyst is lower. Recently, many researchers used the oxidative dehydrogenation catalysts to convert alkanes to alkenes but they have some problems. This reaction is active at high temperature and the initial products are oxidized at this temperature[7,8]. The new route of catalysts in dehydrogenating propane into propylene is MFI type zeolite which incorporate or ion-exchange with some metal [9-12]. Zeolites with MFI pore structure were generally chosen since they are well known that their deactivation by coking is generally slow.

MFI type catalysts are aluminosilicate crystal. The aluminium ingredient in MFI type catalysts are responsible for the formation of strong acid sites for various reactions. The pore structure of MFI type catalysts leads to various types of shape selectivities, i.e. reactant shape selectivity, product shape selectivity and transition state shape selectivity. The three dimensional pore structure of MFI type catalysts is considered to be responsible for its long catalyst life.

Although there are many researches that use MFI type catalysts for the aromatization of light paraffins [13-18], there are only few for light paraffins dehydrogenation to light alkenes [4,12]. Although light alkenes are the intermediates from light paraffins that will be further reacted to aromatics [13,16] ; however, Zn-Al-silicate was found to give high selectivity to light alkenes [19]. The aim of this study is to investigate the effect of the amount of zinc containing in MFI type catalysts on propane dehydrogenation to propylene and the preparation method for this catalysts in addition to find the optimum condition for this reaction.

The Objective of This Study

1. To study the method of preparation of metal-containing MFI-type catalysts.

2. To characterize the prepared catalysts.

3. To study the efficiency of platinum free catalyst in propane dehydrogenation to propylene and find the optimum condition for this reaction.

4. To observe the stability of the prepared catalyst.

The Scope of This Study

1. Study the effect of introducing metals such as zinc and/or aluminum into MFI-type zeolite catalysts.

2. Characterize the prepared catalyst by following methods:

- Analyzing the structure of catalyst by X-Ray Diffraction (XRD)
- Analyzing shape and size of crystallites by Scanning Electron Microscope (SEM)
- Analyzing surface areas of the catalysts by BET Surface Area Measurement.
- Analyzing the acidity of the catalysts by NH_3-Temperature Programmed Desorption (NH_3-TPD)

3. Study the performance of the prepared catalysts on propane dehydrogenation to propylene under the following conditions

- Atmospheric pressure
- Reaction temperature 550-600 ^{o}C
- Space velocity 2,000-10,000 h^{-1}
- Reaction gas 20 % propane with N_2 as diluent

The reaction products were analysed by gas chromatographs.