CHAPTER I

INTRODUCTION

During the last few decades many investigations have been carried out on the conversion of C_3-C_4 liquefied petroleum gas (LPG) into more valuable products, such as aromatic hydrocarbons particularly benzene, toluene and xylene (BTX) [1-9]. Aromatic hydrocarbons have two main industrial uses : (i) because of their high octane number they constitute a significant part of the gasoline pool (about 30%) even if due to antipollution legislations their utilization tends to decrease (ii) they are also an important source of petrochemicals : aromatic chemicals represent about 30% of the total of some 8 million known organic compounds [10]. BTX are now obtained by catalytic reforming of naphthas. But current processes are incapable of converting hydrocarbons with carbon numbers of five or less to aromatics. However light hydrocarbons, in particular LPG, are becoming an attractive feed for the production of aromatics. In particular a process named Cyclar using gallium compounds. All this incited various teams to investigate the aromatization of light alkanes, in particular that of propane, on zeolite catalysts doped with gallium and also with other compounds such as zinc, platinum and bimetallics. Zeolites with MFI pore structure (ZSM-5) were generally chosen since it is well known that their deactivation by coking is generally slow.

ZSM-5 is an aluminosilicate crystal having the MFI pore structure. The aluminium ingredient in ZSM-5 is responsible for the formation of strong acid sites for various reactions. The pore structure of ZSM-5 leads to various types of shape selectivity, reactant shape selectivity, product shape selectivity and transition state shape selectivity. The three dimensional pore structure of ZSM-5 is considered to be responsible for its long catalyst life.

A number of researches have revealed the effective utilization of MFI-type catalyst containing gallium or zinc as the active catalyst for the aromatization of light paraffins [1-3, 6, 12, 13]. Another metal may be either incorporated to replace aluminium in the zeolite framework or ion-exchanged with the existing cation in MFI-type catalyst. Although Ga ion-exchanged MFI-type catalyst has been proposed as the suitable catalyst for this reaction [13], there is only little informations on comparative study of MFI-type zeolite catalysts into which another metal was introduced by different means.

Therefore this study aims to investigate the catalytic performance of various metal containing MFI-type zeolite catalyst on liquefied petroleum gas aromatization and the optimum method of metal introduction was proposed.

The Objective of This Study

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

2. To characterize the prepared catalysts.

3. To investigate the performance of the prepared catalysts on aromatization of liquefied petroleum gas.

4. To observe the stability of the prepared catalyst.

The Scope of This Study

1. Study the method to introduce metals such as gallium, zinc into MFI-type zeolite catalyst either by ion-exchange or incorporation.

2. Study the characterization of the prepared catalysts by following methods:

- Analyzing shape and size of crystallites by Scanning Electron Microscope, SEM.
- Analyzing surface areas of catalysts by Brunauer-Emmett-Teller (BET) Surface Areas Measurement.
- Analyzing the acidity of the catalysts by NH_3-Temperature Programmed Desorption, NH_3-TPD.

3. Investigate the performance of the prepared catalyst on the aromatization of LPG under the following conditions:

- Atmospheric pressure
- Reaction temperature 450-600 °C
- Space velocity 2,000-8,000 h^{-1}
- 20% LPG with N_2 as diluent

The reaction products were analysed by Gas Chromatographs.

4. Study the effect of platinum on the life of the prepared catalyst.