CHAPTER I

INTRODUCTION

After the natural gas exploration in 1973, it has ever since activated both government and private sectors to utilize it industrially and commercially to the maximum benefit. Then the investment to constitute the refinery was carried out at the eastern seaboard. The purpose of the refinery is to separate various gas components out. The use of the separated natural gas is enormous, for example, methane is the raw material for fertilizer manufacturing and energy generation. Ethane and propane are dehydrogenated at the NPC plant to produce ethylene and propylene, respectively. These two compounds are used in downstream factories to produce plastics by polymerization. Therefore, the domestic plastic production can compensate significantly the imported plastics. The rate of plastic consumption in Thailand increases the plastic production abruptly.

Thailand has imported the foreign technology at a huge value of foreign exchange. One of the most important technologies in petrochemical industries is catalyst technology. Its avarices has progressed continuously. It can transform hydrocarbons to the more valuable petrochemicals. Catalyst technology is the milestone of various petrochemical processes. It can improve the operating conditions and lessen the reaction severity. Consequently, it also increase the productivity, selectivity and quality of product. Finally, it cuts the production cost effectively.

The plastic which is widely used for many applications is high density polyethylene(HDPE). It can be produced from the four main types of catalytic polymerization. There are the following:

1. Slurry polymerization in light hydrocarbons,
2. Slurry polymerization in hexane,
3. Gas phase polymerization,
4. Solution polymerization.

The polyethylene obtained from each process possesses different properties due to the different catalyst components and process conditions.

The Ziegler-Natta catalysts have been investigated for a long time since mid-1950's and attempts have been put to improve its productivity. The significantly technological advances based on new and improved catalysts have been made, but the comprehensive knowledge of the Ziegler-Natta catalysts is still weak. The study of ethylene polymerization by the high-activity Ziegler-Natta catalyst was carried out to implement this knowledge. As the results of the above mentioned experiments, it will create our own knowledge and technology for the high-activity Ziegler-Natta catalytic polymerization of ethylene. As a consequence, our country can stand on this technology firmly in the near future.

1.1 The objectives of the thesis

1.1.1 To study techniques and procedures for preparing the high-activity Ziegler-Natta supported catalyst. The techniques and procedures are concerned not only with the chemistry, but also the kinetics and many effects of catalytic polymerization.

1.1.2 To find out the suitable condition for ethylene polymerization by the high-activity Ziegler-Natta supported catalyst. The unsupported catalytic polymerization condition is used as a reference for the supported one. The study will first focus on the unsupported system and then the supported one to clarify the increase in activity.

1.1.3 To study the additional effects of the modification with a high-activity Ziegler-Natta supported catalyst system with one modification with a transition metal. The polymerization rate, yield and physical and chemical properties of the resulting polyethylene are also studied.

1.1.4 To characterize the polyethylene obtained from the high-activity Ziegler-Natta supported catalytic polymerization.

1.2 The scope of the thesis

1.2.1 To study the techniques and procedures to prepare the high-activity Ziegler-Natta supported catalyst. The suitable condition to prepare the catalyst which was used to polymerize ethylene at the particular condition was investigated in detail.

1.2.2 To investigate the catalytic activity by varying the following parameters: Partial pressure of ethylene, Partial pressure of hydrogen, Triethylaluminum / titanium atomic ratio.

1.2.3 To study the effects of Fe_2O_3 compound on the high-activity Ziegler-Natta supported catalyst of the polyethylene yield and its properties by varing the %Fe/Ti atomic ratio.

1.2.4 To determine the chemical and physical properties of the polyethylenes obtained from the optimum conditions of the high-activity Ziegler-Natta supported catalytic polymerization.

This thesis consists of 6 chapters. The reason for "Ethylene Polymerization on High Activity Ziegler-Natta supported catalyst" being chosen as the topic of this thesis; the important role in the Ziegler-Natta catalysts in plastic industry; the objectives of the thesis and the scope of the work are briefly written in Chapter I. The publications of the articles and patents on the olefin polymerization are summerized in Chapter II. General concepts of Ziegler-Natta catalyst chemistry, the role of $MgCl_2$ in the supported catalyst, the preparative methods of the high-activity Ziegler-Natta supported catalyst are briefly described in Chapter III. The concepts of polymerization, kinetics, mechanisms, and factors that control the polymer properties are also included. In Chapter IV, the details about chemicals, equipments, procedures, characterization methods of polyethylene used in the thesis are expressed. Results and discussion in the experiment are reported in Chapter V and finally conclusion and recommendation are in Chapter VI.