



## CHAPTER I INTRODUCTION

Since the discovery of Ziegler-Natta catalysts for alpha olefin polymerization, these catalysts have become the most famous and marvelous in the last four decades. In 1953 high-density polyethylene was made at low pressure with a binary mixture of metal alkyls and transition metal salts in an inert hydrocarbon medium in the laboratories of Karl Ziegler. Giulio Natta extended the ability of these catalysts by slightly modifying the catalysts to allow formation of highly stereospecific polymer from other alpha olefins (e.g., propylene) (Boor, 1979; Yermakov *et al.*, 1981). There has been continuing intensive research effort to improve the performance and to know the mechanism of the catalyst intensively, both in industry and academia.

Ziegler-Natta catalysts are a mixture of a metal alkyl of base metal of group I to III (e.g., Li, Al, Mg) and a transition metal of group IV to VIII (e.g., Ti, V, Cr, Zr). The possible combinations are active only for certain monomers or under certain operating conditions.

After Ziegler-Natta catalysts were discovered, much research to gain higher efficiency of the catalysts has been done. The catalysts have evolved into a supported form by dispersing the transition metal onto solid supports which provide the efficient use of the transition metal as an active center. Many types of supports such as magnesium compounds, silica and alumina have been employed. But the most widely used supports are magnesium compounds, especially  $MgCl_2$ . Due to the fierce competition in the polyolefin industry, much of the research in recent years has focused on a highly active  $MgCl_2$  supported catalyst which is the most common commercial catalyst. Thus, the  $MgCl_2$  supported catalyst is used in this thesis.

The supported catalysts are much more active than the unsupported catalysts. However, these supported catalysts cannot produce highly isotactic polypropylene without any modifier. The Lewis base compounds are used to fulfill this requirement. A large number of Lewis bases such as ethers, esters, amines, and silanes have been used as a modified agent. The Lewis bases have been used during catalyst preparation (internal donor) as well as during polymerization (external donor) to improve stereospecificity of the catalysts. But these modifiers usually have adverse effects on catalytic activity. In this studied we use dibutylphthalate as an internal donor and cyclohexylmethyldimethoxysilane as an external donor.

Many researchers have investigated propylene polymerization with Ziegler-Natta catalysts in the past. The basic principle of kinetics and the mechanism were suggested by Natta. Moreover many works have studied the polymerization kinetics, mechanism of polymerization, catalyst performance with respect to a variety of catalyst systems and stereospecificity of polymer. To a significant extent, the nature of the catalyst and many effects on stereospecificity are not completely known.

In this research, we will investigate the effect of external donor/Ti ratio (cyclohexylmethyldimethoxysilane) and ethylene content in the random ethylene propylene copolymer on the isotacticity, melting temperature, and crystalline temperature on the random ethylene propylene copolymer. Furthermore, the synthesized copolymers will be characterized for their molecular weights and molecular weight distributions.