CHAPTER I
INTRODUCTION

The Ziegler-Natta catalyst for alpha olefin polymerization is the most marvelous and prominent catalyst in the last four decades. In 1953 Karl Ziegler revealed that high density polyethylene was facilely polymerized at low pressure with binary mixture of metal alkyls and transition metal salts. In the next year Giulio Natta exhibited the same type of catalysts with slight modification to form isotactic polymers from other α-olefins (e.g., propylene). Both Ziegler and Natta shared the Nobel prizes for chemistry in 1963 to acclaim their contributions (Boor, 1979; Moore, 1996).

Generally, the Ziegler-Natta catalyst is a complex mixture formed from reaction of a transition metal compound (halide, alkoxide, alkyl, or aryl derivative) of group IV-VIII transition metals (known as the catalyst) with a metal alkyl, hydrides or alkyl halide of group I-III base metals (known as the cocatalyst). Actually, only a few group IV-VIII transition metal compounds containing titanium (Ti), vanadium (V), chromium (Cr) and zirconium (Zr) are effective. Also, metal alkyl which is aluminum alkyls such as $AlEt_3$, Al-i-Bu_3, $AlEt_2Cl$, $AlEtCl_2$, and $AlEt_2(OR)$ are used. Not all of the possible combinations are efficient, many of these combinations are active for specific monomers or under particular conditions.

Polypropylene resins have been polymerized from Ziegler-Natta catalyst of several forms; e.g. soluble, colloidal, supported, unsupported, heterogeneous, etc. for over 40 years. However, the supported catalyst especially $MgCl_2$ is the most important and the most commercial used because of the ferocious marketing in the polypropylene industry and the very broad range of applications of their products. Also, many researchers have

investigated the highly active Ziegler-Natta supported catalyst in last few years.

After Ziegler-Natta catalyst was discovered, it was found that electron donors (known as Lewis bases) could extremely influence the catalyst's kinetic and stereoregularity. Lewis base compounds such as amines, ethers, silanes, and esters were used as additives in the solid catalyst (so called "internal donor") and also in polymerization system (so called "external donor") to form complex by reacting with the components of the catalyst or the active centers. They have been used in order to increase catalyst activity and/or stereospecificity. In this thesis, we use di-n-butylphatalate as an internal donor and five different compounds as external donors.

In the past decades, numerous researchers have examined propylene polymerization with Ziegler-Natta catalysts. Although the kinetics study principles and mechanism were suggested by many researchers. But these knowledges still can not be completely explained how the compounds of external donor affect on catalyst system and stereospecificity.

In this research work, we will use $MgCl_2$-supported catalyst and examine the effect of external donor/cocatalyst, external donor/catalyst, cocatalyst/catalyst, and hydrogen content in polypropylene on activity, isotacticity, melting temperature, and crystallization temperature. Moreover, the polypropylene resins will be characterized for their molecular weights and molecular weight distributions.