CHAPTER I
INTRODUCTION

Crystallization of semi-crystalline polymers is of great importance in polymer processing, because many resulting physical properties are strongly related to the morphology formed and the extent of crystallization during processing. The crystallization of polymers is controlled mainly by nucleation and growth mechanisms, but the nucleation mechanism plays more important role in the crystallization of polymers either from solution or melt. The nucleation rate depends on the number of heterogeneous nuclei (e.g., impurity, catalyst residue, additive, nucleating agents) present in the polymers.

Addition of nucleating agents into polymers has become an important method for accelerating the crystallization process, hence reducing the processing time and/or improving the optical and mechanical properties of the final products. However, both chemical and physical properties of the added particles (i.e. surface chemistry, shape, surface area, etc.) are important factors affecting crystallization of polymers. Generally, various organic and inorganic particles are used as nucleating agents. Nucleating agents can be divided into two types: inorganic and organic. Inorganic nucleating agents are, for examples, talc, mica, barium sulfate ($BaSO_4$) and calcium carbonate ($CaCO_3$). Organic nucleating agents are, for examples, organic phosphate and sorbitols including their derivatives.

Syndiotactic polypropylene (sPP) was successfully synthesized late in the last decade based on the then new metallocene catalysis system (Ewen *et al.*, 1988), instead of the traditional Ziegler-Natta catalysis system (Natta *et al.*, 1488). This novel catalyst system has produced sPP with much improved regio- and stereo-regular structure, purity and yield. Possible applications for sPP are in areas such as fibers and films. Since sPP is a very slow crystallizing polymer (Supaphol, 2000), endeavor is sought for improving the crystallization rate, hence shortening the processing time. In iPP, $CaCO_3$ is not only used to accelerate the crystallization process, but also to improve mechanical integrity. To the best of our knowledge, studied related to filled sPP systems have been focussed on fillers like glass beads, talcum (Stricker *et al.*, 1997), and $CaCO_3$ of varying particle sizes and surface

modifications (Supaphol and Harnsiri, 2004). Therefore, it is of our interest to study the effect of different particulate fillers as nucleating agents on crystallization behavior and mechanical properties of sPP compounds. The crystallization kinetics of sPP compounds is also interesting.

There have been many reports on crystallization and mechanical properties of iPP, but very few on sPP. On sPP, only few reports on the effect of nucleating agents on crystallization of sPP are available in the open literature. The aim of this work is to study the effect of different nucleating agents on crystallization and subsequent melting behavior of sPP under non-isothermal crystallization conditions. Effects of these nucleating agents on processability and mechanical properties of sPP compounds are also investigated.