CHAPTER 1

INTRODUCTION

Isotactic polypropylene (iPP),as known as PP,is one of the most important commodity polymers. Polypropylene has been widely used in many areas of applications ranging from toys, consumer products, engineering or industrial products to specialty products with high performance. Polypropylene offers many advantages such as low cost, easy to process, good resistance to chemicals and good mechanical properties. The moderately high toughness and elongation to break of PP is its unique characteristics. However, for certain applications such as high performance or specialty films, an enhancement of mechanical properties of PP (in particular toughness and elongation) is still necessary. Current attempts at enhancing mechanical properties of PP films involve improvement of molecular weight, filler addition, and modification of the PP's structure. Nevertheless, the enhancement of PP film's mechanical properties by modification of structure, orientation and morphology has received considerable attention. Structure modification of the iPP are largely based on developing and/or controlling the PP's crystal structure giving rise to the desirable properties of the product. The structure modification of PP mainly involves its four major crystal forms of α (monoclinic),β (hexagonal),γ (triclinic)and smectic (partial order of micro crystal of hexagonal and/or monoclinic). In general, the α form is present in iPP and can be transformed to other crystal structures through different conditions or methods such as orientation, deformation, and heat treatment etc. Of all these crystal forms, the β form demonstrate better properties in elongation and toughness which is desirable in general high performance film applications.

Numerous investigations have been carried out involving the subject of the β-iPP crystal structure but most previous studies were only concentrated on the technique that obtained a high level of the β crystalline form. The three techniques used to promote β form include thermal gradient, β nucleator addition, and shear induced techniques. Among these three technique, the addition of β nucleator was found to be a very effective method for promoting β form in iPP. There are many types of β nucleators for

iPP. The β nucleator that has been of great interest is quinacridone pigment (Permanent Red E3B) due to its high efficiency in creation of the β form iPP. Many earlier studies on quinacridone modified iPP have investigated effects of the quinacridione on structure and properties of the PP under laboratory conditions. However, there have been very few studies in the literature focussing on the structure development during compounding or processing of β nucleated PP. Therefore, the main purpose of this thesis was to explore effects of the selected β nucleator (quinacridone of Permanent Red E3B) on the morphology and corresponding properties of compression molded and extruded PP films prepared by common mixing processes being used in industrial production. Three major objectives of this study were as follows: 1) to study effects of the selected β nucleator on crystalline structure and mechanical properties of the modified iPP,2) to investigate the relationships between a compounding or processing method and β phase formation in polypropylene-quinacridone system,and3) to understand important parameters controlling β crystalline structure as well as final mechanical properties of the PP films.

As an additional feature, a preliminary study on film porosity influenced by the presence of selected β nucleator combined with effect of film forming process was also conducted. Relative gas permeability of the PP compression molded and cast films with or without the nucleator were also determined and compared.