

## CHAPTER II

### LITERATURE REVIEWS



#### 2.1 Synthesize PE-b-PP copolymer

Shingo Tsubaki *et al.* [9] synthesized of terminally hydroxylated and iodinated isotactic polypropylenes were carried out by the reactions of oxygen and iodine with polymer-Al bonds produced in propylene polymerization with  $[\text{ArN}(\text{CH}_2)_3\text{-NAr}]\text{TiCl}_2$  ( $\text{Ar} = 2,6\text{-}^i\text{Pr}_2\text{C}_6\text{H}_3$ ) combined with methylaluminoxane (MAO) as a cocatalyst. After that, the polymer was synthesized and characterized, it was found that the content of the terminally functionalized isotactic poly(propylene) was more than 80 mol-% in all cases.

Takeshi Shiono, Kap Ku Kang, Hideaki Hagihara, and Tomiki Ikeda [10] prepared vinylidene-terminated PP by the  $\text{MgCl}_2$ -supported  $\text{TiCl}_4$  catalyst using  $\text{AlEt}_3$  as cocatalyst by means of dehydroalumination of Al-C bonds. The polymerization was quenched by oxygen gas, and the polymer was fractionated into atactic and isotactic parts with boiling heptane. Each part was analyzed by  $^1\text{H}$  NMR. The spectra showed the resonances of vinylidene, vinyl, and hydroxymethylene groups, whose intensities were strongly dependent on the polymerization temperature and the stereoregularity. Raising the polymerization temperature increased the intensity of the hydroxymethylene group in both parts. The relative intensity of the hydroxymethylene to that of the vinylidene group was much higher in the atactic parts.

Jun-Ting Xu, Ping-Jing Ding, Zhi-Sheng Fu and Zhi-Qiang Fan [11] founded that a series of ethylene-propylene block copolymer fractions of differing composition, while still retaining broad molecular weight distributions, were obtained by fractionation of polypropylene (PP) and polyethylene (PE) copolymers prepared by sequential polymerization of ethylene and propylene. The crystallization and melting behavior of the polypropylene-block-polyethylene fractions were studied. It was observed that the major component could suppress crystallization of the minor component, leading to a decrease in crystallinity and melting temperature. Non-isothermal crystallization showed that crystallization of the ethylene block was less influenced by composition and the cooling rate than the polypropylene block. At fast cooling rates, the ethylene block could crystallize prior to the propylene block. Isothermal crystallization kinetics experiment was also conducted. They found that the block copolymer with minor ethylene components had smaller Avrami exponents ( $n \approx 1.0$ ), hence indicating a reduced growth dimension of the PE crystals by the pre-existing PP crystals. On the other hand, the ethylene block exhibited much larger Avrami exponents in those block copolymers with major ethylene contents.

Zhenhua Sun, Fusheng Yu, Fusheng and Yu Yuchen Qi [12] studied the morphology, thermal properties and characterization of commercial ethylene-propylene block copolymers by  $^{13}\text{C}$  nuclear magnetic resonance (n.m.r) spectroscopy (SEM). The results obtained that there exists some ethylene-propylene random copolymer in the block copolymer extractable by n-heptane. The possibility of forming PP-b-PE diblock copolymer is questionable on the basis of the effect of the residual propylene and the chain-transfer reaction in the sequential copolymerization. A difference in the thermal properties between commercial ethylene-propylene block copolymer and PP/PE blend was noticed, which cannot be used to identify PP-b-PE diblock copolymer. The multiphase structure has been confirmed by DMA and SEM,

with ethylene-propylene random copolymer and polyethylene forming the domains in the matrix of polypropylene.

Zhi-sheng, Zhi-qiang Fan, Yu-qing Zhang, Lin-xian Feng [13] synthesized the polypropylene/poly(ethylene-co-propylene)(iPP/EPR) in situ blends of different composition by Ziegler Natta catalyst and the polymers were fractionated into three portions: the random copolymer (EPR) the block copolymer, and the iPP matrix. The EPR fraction was characterized by  $^{13}\text{C}$  NMR, and the block copolymer fraction was characterized by crystalline segregation and differential scanning calorimetry analysis. The blends showed bi-phase structure with EPR existing in the dispersed phase. Increasing EPR in the blends resulted in increase of the number and diameter of the EPR particles, but there is an upper limit for the particle number. There were only highly irregular spherulites or tiny crystallites in the isothermal crystallized blends. The morphology of the impact fracture surfaces of the blends clearly showed that they were fracture in the ductile fashion. There was strong dependence of the impact strength of the blends on their morphologies, and the sequence distributions of the EPR and segmented copolymer fractions also markedly influenced the mechanical properties.

## 2.2 Blending and Mechanical Properties

S. Hong *et al.* [14] studied the morphology of a semicrystalline polyolefin diblock copolymer polyethylene-*b*-atactic-polypropylene (PE-*b*-aPP) and its blends with polyethylene homopolymer. By using  $\text{RuCl}_3/\text{NaClO}$  as the staining agent, both the contrast between amorphous PP and amorphous PE regions and the contrast between amorphous PE regions and crystalline PE regions can be obtained. As a result, both the larger lamellae structures due to microphase separation and the