สำนักงานวิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

CHAPTER I
INTRODUCTION

Nylon 6 (PA6) is an important commercial polymer with a wide variety of applications as an engineering thermoplastic and in textile fibers due to its outstanding properties such as high hardness, rigidity, and abrasion resistance, its good barrier to oxygen and organic solvents. However, PA6 has a number of deficiencies, e.g. brittleness, low melt strength, high moisture absorption, poor dimensional stability, and poor processability, which has limited it use. Low density polyethylene (LDPE) is an ideal plastic for packaging and container industrial applications because of its ease of processing, low temperature flexibility, high impact strength, and good barrier to moisture vapor and inorganic solvents. Blends of PA6 and LDPE are prepared in an attempt to improve the barrier properties, impact strength (toughness), and dimensional stability of PA6, and to reduce the organic solvent and oxygen permeability of LDPE. The good properties of each polymer can be utilized in blends of the two types of polymers used.

Polymer blending is not only economically viable but is also a versatile way of making new materials having a wide range of properties. However, blending of PA6 with LDPE gives a thermodynamically immiscible and mechanically incompatible two-phase system. Immiscible blends often exhibit poor mechanical properties and have unstable phase morphology during melt processing. The reason for this is the unfavorable interaction between molecular segments of the components, which leads to a large interfacial tension in the melt, so the dispersion of the components during mixing is, therefore, difficult and coalescence occurs at quiescent concentrations. The use of a suitable compatibilizer can generally remedy these problems of incompatibility. The appropriate selection of a compatibilizer can promote a stable, fine distribution of the dispersed phase within the matrix phase by reducing the interfacial tension between the blend components and retarding dispersed phase coalescence via steric stabilization. Surlyn®, an ionomer was used as compatibilizer for this study.

Surlyn® ionomer compatibilizer is an ethylene/methacrylic acid (E-MAA) copolymer neutralized with zinc. Ionic side groups on the polyethylene main chain combine, via metallic ions, to form labile crosslinks; the ionic crosslinks dissociate at high (processing) temperatures. Thus, the material flows like conventional thermoplastics when molten but has properties characteristic of thermosets when solid. This compatibilizer was chosen because it consists of ethylene segments similar to LDPE, and carboxylic acid functional groups of the ionomer that can react with the amine end groups of the PA6, giving rise to strong links between the two phases. Moreover, amide groups may also interact with the ionomer via hydrogen bonding and ion-dipole interactions.

In this work, PA6/LDPE/Surlyn® ionomer ternary blends are investigated in terms of kinetic thermal parameters, co-crystallization behavior, and morphology over a range of compositions. In addition, PA6/Surlyn® ionomer and LDPE/Surlyn® ionomer are studied in order to get a better understanding of the influence of the compatibilizer in PA6/LDPE/Surlyn® ionomer ternary blends.