CHAPTER I
INTRODUCTION

High performance properties of materials; for example chemical resistance, low water absorption, high strength, high impact resistance, and barrier properties, are required for specialized applications. A simple process to produce a new material is by blending two or more polymers. Polyamide-6/high-density polyethylene (Nylon 6/HDPE) blends have been widely investigated. Nylon 6 shows high tensile strength and has good barrier properties, while HDPE shows good impact resistance, and good low temperature flexibility. Nylon 6/HDPE blends are thermodynamically immiscible and generally have poor ultimate mechanical properties. When these immiscible blends are subjected to stress, the stress concentrates at the interfacial phase of immiscible blends which in turn tend to serve as failure initiation nuclei (Chen, et al. 2004;Padwa 1992;Utracki, et al. 1986 ;Wills and Favis 1988;Wills, et al. 1993).

The properties of immiscible blends can be enhanced by adding a third component which is an interfacially active material termed a compatibilizer. Compatibilizers promote physical and/or chemical interactions between each polymer component. Frequently, polymeric materials based on derivatives of carboxylic acid groups are used as compatibilizers. In this case, compatibility of the blend is achieved by interactions of the carboxylic acid and the active functional group of one or both of the polymers.

Many kinds of acid-functionalized compounds have been proposed as compatiblizers for polyamide/polyolefins blends; for example, ethylene-methacrylic acid copolymer (E-MAA) (Filippi, et al. 2002;Wills and Favis 1988;Wills, et al. 1993), acrylic acid grafted polyethylene (PE-g-AA) (Filippi, et al. 2002;Psarski, et al. 2000;Qiu, et al. 1999), and maleic anhydride grafted polyethylene (MAH-gPE) (Chandramouli and Jabarin 1995;Chen, et al. 2004;Guruprasad and Chanda 1999 ;Ide and Hasegawa 1974;Jiang, et al. 2003 ;Kim, et al. 2009 ;Kudva, et al. 1999 ;Pan, et al. 2001;Qiu, et al. 1997 ;Yao, et al. 2000). These compatibilizers promote reactions between amine groups (terminal $-NH_2$ or -RNH) of Nylon6 with carboxylic acid functional groups and/or interactions between carboxylic acid groups and these polyamide functional groups (Lahor, et al. 2004;Leewajanakul, et al. 2003;Sinthavathavorn, et al. 2008;Wills and Favis 1988;Wills, et al. 1993).

The aim of this work was to study the effect of zinc-neutralization of hydrolyzed anhydride acid groups in MAH-gHDPE with respect to the efficiency of compatibilization. Zinc acetate dihydrate ($Zn(CH_3COO)_2 \cdot 2H_2O$) was used as a neutralizing agent for the melt-neutralization reaction. Zinc acetate dihydrate rather than zinc oxide (Chatreenuwat, et al. 2007) as was done in our previous work was employed to see if there were any significant differences in behavior between the two neutralizing agents. Zinc oxide is used commercially to neutralize similar materials (e.g. ethylene methacrylic acid) because of cost; however, the acetate might neutralize differently because the neutralization chemistry is more straightforward and the acetic acid byproduct of the acetate should evaporate during melt neutralization. Characterization of phase morphology, mechanical properties, thermal properties, and rheological properties of the obtained Nylon 6/HDPE blends with and without MAH-gHDPE and zinc neutralization of MAH-gHDPE have been carried out.