

CHAPTER I

INTRODUCTION



Presently, polymeric materials are used in many applications. Each application requires different kinds of materials with different properties. So polymeric materials are improved for better properties, lower cost, and endurance with their applications.

The properties of polymer can be improved by adding various additives, such as fillers, antioxidants, reinforcements, plasticizers or others. Reinforcing fibers and other fillers are popular as an additive for polymers. In general, fibers and solid fillers tend to increase the modulus of a composite when used in proper amount [Huh and Weiss, 1983]. Associated with their effects of stiffness, reinforcing fillers tend to lower the coefficient of thermal expansion of the polymer [Huh and Weiss, 1983]. In this regard, stiff fibers can be added to a polymer in order to reduce the shrinkage encountered upon cooling the molten polymer after common processing operations. However, the addition of fiber to a polymer increases its melt viscosity, which increases the amount of power consumed in processing steps [Huh and Weiss, 1983], [Patwardhan and Belfiore, 1988].

Physical blends of chain molecules with low molar mass liquid crystal might be of interest to the scientific community, by using liquid crystal as

plasticizing and reinforcing fillers for amorphous polymers [Patwardhan and Belfiore, 1988]. In this respect, the addition of low molar mass liquid crystal to amorphous polymer was suggested as an alternative method to induce modest improvement in the mechanical properties of the resulting polymeric composites. Due to the mechanical anisotropy which results from molecular alignment, the liquid crystal molecules can orient themselves in the shear field characteristic of a processing operation [Patwardhan and Belfiore, 1988].

In United States patent [4,434,262], Buckley, A., Conciatori, A. B., and Calundann, G. W. [1984] studied an improved melt processable blend comprising of a polymer selected from the group consisting of a polyolefin and a polyester and a low molar mass liquid crystal compound which is capable of forming an anisotropic melt phase at the melt processing temperature of the blend.

From above mentioned, it is interesting to study the polymer blended with low molar mass liquid crystal. Two low molar mass thermotropic liquid crystal in phenyl-cyclohexylbenzoates group: HP35 and HP5N, were chosen to blend with two noncrystalline polymers, one from the widely used thermoplastic: polystyrene, and the other is outstanding engineering thermoplastic: poly(bisphenol A carbonate). The phase diagrams of the blends between these polymers and the low molar mass liquid crystal were studied to provide the information about suitable composition of the blend components.

The phase diagrams which are important for the temperature control of the melt mixing process were investigated by Differential Scanning Calorimeter (DSC). This phase diagram may not be the same as the phase diagram under shear, but it will give the guide line to control the temperature of the mixer.

1.1 THE OBJECTIVES OF THE PRESENT STUDY

- 1.1.1 To develop a procedure used to construct the phase diagram of the polymer blended with low molar mass liquid crystal.
- 1.1.2 To construct a phase diagram of the polymer blended with low molar mass liquid crystal by the methods developed in this study.
- 1.1.3 To study the effects of low molar mass liquid crystal on the transition temperatures of the blends.

1.2 THE SCOPE OF THE PRESENT STUDY

The phase diagrams of the polymer blended with low molar mass liquid crystal at the low concentration range of low molar mass liquid crystal will be constructed. There are four systems in this study:

SYSTEM I: Polystyrene & HP35

SYSTEM II: Polystyrene & HP5N

SYSTEM III: Poly(bisphenol A carbonate) & HP35

SYSTEM IV: Poly(bisphenol A carbonate) & HP5N