CHAPTER I
INTRODUCTION

1.1 Polymer blends

Polymer blending is a convenient route for the development of new polymeric materials, which combine the excellent properties of each component. This strategy is usually cheaper and less time-consuming than the development of new monomers and new polymerization routes, as the basis for producing entirely new polymeric materials. Polymer blending usually takes place in processing machines, such as twin-screw extruders, which are considered standard industrial equipment.

Thermoplastic elastomer is a comparatively new group of materials that can be prepared by mixing a thermoplastic and an elastomer under high shearing action. Plastics like polypropylene, polyethylene, nylon, polystyrene, polyester, etc. and elastomers such as EPDM, natural rubber, SBR, etc. are usually used as blend components. It is possible to improve the mechanical properties and processability by appropriate combination of polymer components.

Though blending looks very attractive, most of the polymer blends often exhibit poor mechanical properties due to incompatibility resulting from the lower entropy of mixing of high molecular weight polymers and the unfavorable enthalpy interaction between the constituent components. However the properties of these polymer blends can be improved by the addition of compatibilizers.

Compatibilizers are macromolecular species exhibiting interfacial activities in heterogeneous polymer blends. Usually the chains of a compatibilizer have a blocky structure, with one constitutive block miscible with one blend component and a second block miscible with the other blend component. The role of compatibilizer is similar to the emulsifying effect of

surfactant in the oil-water emulsion system. A suitable compatibilizer will locate at the interface between the blend components and thereby reduce the interfacial energy resulting in improved interfacial adhesion and mechanical properties.

In this study, linear low-density polyethylene (LLDPE) is blended with natural rubber (NR) to increase the melt strength in the film blowing process. Maleic anhydride is used as compatibilizer to increase the interfacial adhesion between LLDPE and NR. Calcium carbonate is also used in the blend system as a filler.

1.2 Rheology

As the processing of polymers in most cases involves flow of the material, a thorough understanding of the flow characteristics of the composite is essential. There are two fundamental rheological properties that are of primary concern in polymer processing. They are viscous and elastic properties. These rheological properties depend on two main factors. First is the flow conditions which consist of the shear rate, temperature, and pressure. Second is the polymer characteristics such as the chemical structure of the polymer, the molecular weight distribution of the polymer, the presence of long chain branches, and the nature, type and concentration of additives and/or fillers. Therefore a better understanding of the interrelationships between the rheological properties and the molecular characteristics, and between the rheological properties and processing conditions, is essential for developing a criterion for evaluating the processability of polymeric materials. For instance, viscosity data and melt elasticity behavior at various temperature help one in selecting the processing conditions and in designing the processing instruments. In this study we would like to study the rheological properties of the LLDPE/NR blends by using a cone-and-plate rheometer at low frequency and a capillary rheometer at high shear rate.