

The Effect of Transesterification Reaction on the Morphology and Mechanical Properties of Phenoxy and LCP Blends

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INTRODUCTION

Thermotropic liquid crystalline polymers (LCPs) have been the subject of active research interests in the past few years because of their potential use for high strength, high modulus, and chemically resistant materials.¹⁻³ Blending the LCPs with conventional thermoplastics allows the achievement of improved mechanical and physical properties and an easier processability of the blends. However, many of these blends show poor miscibility between the blend components and have a heterogeneous structure. The apparent compatibility can possibly be increased by interchange reaction between the blend components.⁴ In this study, the effects of transesterification in the morphology, rheological and mechanical properties of poly (hydroxy ether of bisphenol A) (Phenoxy) and LCPs were investigated.

EXPERIMENTAL

The commercial grade Phenoxy (PKHH from Union Carbide Corporation) and LCP (Vectra A950 from Hoechst Celanese Corporation) were used without further purification. All polymers were completely dried under vacuum before blending. The component polymers were melt-blended by mechanical mixing and then injection molded on the Mini-Max injection molder (Model CS-183 MMX, Custom Scientific Instruments, Inc.). The molding temperature was 290°C. The molded dumbbell type specimens were tested on a tensile tester with a cross-head speed of 1 mm/min. The rheological properties of the blends and their components were determined on a Rheometrics Mechanical Spectrometer (RMS 800). The morphology of blends was investigated with scanning electron microscope (SEM, JEOL JSM-35).

RESULTS AND DISCUSSION

The influence of the LCP content on the viscosity of the blends is seen in Figure 1, where complex viscosity (η^*) is reported as a function of the composition at fixed shear rates. A minimum is shown at a concentration of the liquid crystalline content of about 10% range. The reduced viscosity of the blends with a LCP has been attributed to different reasons, 1) incompatibility between the two phases and 2) formation of elongated fibrils of LCP phase which tend to lubricate the melt. For the Phenoxy/LCP (7/3) blend molded at 290°C for 5 min (Figure 2a), the elongated particle of LCP is dispersed in Phenoxy matrix. It can be seen from the photograph that the adhesion between the LCP and Phenoxy seems to be poor. Figure 2b shows the evidence of an interfacial adhesion between two polymers because the number of neat holes are decreased and surfaces of microfibrils are rough. This indicates that by increasing the processing time, the interfacial adhesion between two polymers is improved.

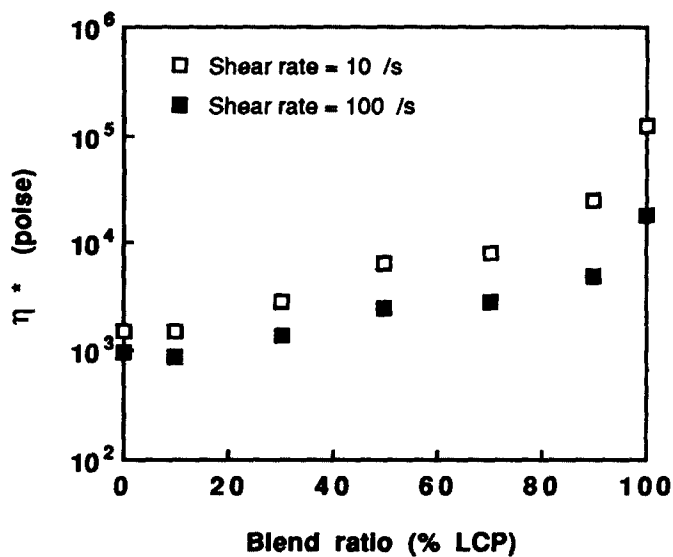


Figure 1. Viscosity vs. LCP content at fixed shear rates at 290°C.

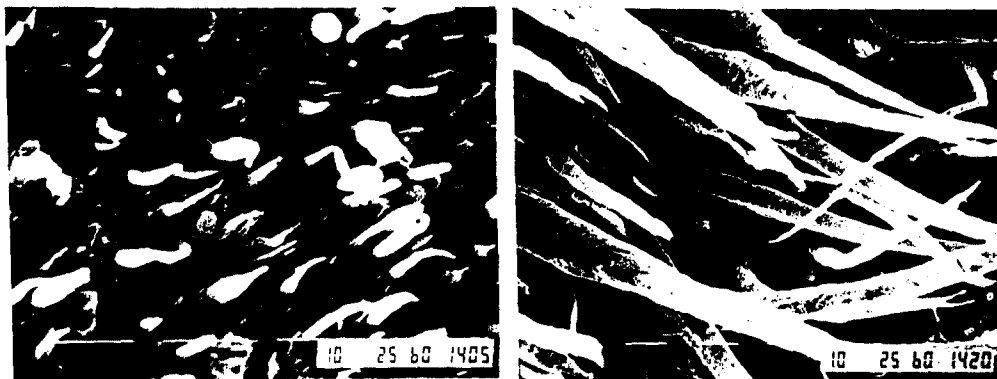


Figure 2. Scanning electron micrographs of the Phenoxy/LCP (7/3) blends molded at 290°C for 5 min (a); for 90 min (b).

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