Abstract

Thermotropic liquid crystalline polymer (TLCPs) are a special type of engineering thermoplastics which form highly ordered structure in molten state. Their rigid rod-like molecular conformation and the stiffness of the backbone chains impart a high degree of orientation during melt processing and forms structures in the final product. LCP has shown that they can impart fiber reinforcement when melt blended with thermoplastics and elastomers. The LCP is also capable of reducing the melt viscosity when melt blended with thermoplastics and elastomers. The purpose of this chapter is to outline how thermotropic liquid crystalline polymers (TLCPs) may be the material to use to get rid of some of these problems. LCP blends will also be presented to illustrate their potential as the reinforcing phase in composites and also it includes discussion on compatibility of these blends. Emphasis will be placed on several properties of the blend system in addition of different types of compatibilizer.

The present investigation has therefore been under taken with a view to develop blends of LCP and suitable thermoplastics and elastomers by melt mixing techniques.

Four different thermoplastics and one elastomer has been chosen for the present studies are Poly (tetrafluoroethylene) (PTFE), Poly (ether sulfone) (PES), Ultra high molecular weight polyethylene (UHMWPE), Acrylonityrile butadiene styrene polymer (ABS), and Vinyl polymer (VMQ). The blends of thermoplastics and elastomers with liquid crystalline polymers were prepared by melt mixing techniques at different blend ratios and with different compatibilizers.

The dynamic mechanical, thermal, crystallinity, morphological and cure characteristics of these blends were investigated.

The SEM study revealed the fibrillation of LCP domains in the predominant PTFE matrix phase whereas, at higher level of LCP the characteristic fibrillation of LCP was not prominent due to decrease in the amount of high viscosity matrix polymer. The storage modulus of the blends increasing with increasing LCP content due to high intrinsic modulus of LCP. The TGA study indicates decrease in thermal stability of the blends with increasing LCP content due to lower thermal stability of LCP than the PTFE.

The SEM study revealed a fine fibrillation of LCP domains in the matrix phase, however, in presence of glass fiber the characteristic fibril nature of LCP some what reduced. The coupling agents significantly affected the phase morphology of the blends due to the interaction at the interface between VMQ and LCP. The thermal stability of the silicone rubber decreased with the addition of LCP, which is further decreased in presence of glass fiber plus coupling agents due to decrease in crystallinity.

The micrograph of ABS/LCP containing blend shows the fibril nature of the LCP domains in the predominant ABS matrix phase. These fibrils are very long and thin, which were dispersed homogeneously in the matrix phase. But in case of sample containing nanosilica as a compatibilizer it shows a clear and distinct phase of fibrillation indicating that in presence of nanosilica the blend shows the best thermal, dynamical and crystalline character.

The thermal, dynamic mechanical and crystalline properties appreciably increase in case of the blend containing

Zn^{++} coated nanosilica encapsulated with epoxy as compatibilizers as compared to the others in the UHMWPE/LCP system.

Keywords: Liquid crystalline polymer, Polytetra fluoro ethylene (PTFE), Polyether sulfone (PES), Ultra high molecular weight polyethylene (UHMWPE), Acrylonityrile butadiene styrene polymer (ABS), and Vinyl polymer (VMQ), crystallinity, thermal stability, morphology, nanosilica (NS), epoxy encapsulated nanosilica (ENS).