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Encapsulation in Polyamide/Polyester/Phenoxy blends

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Introduction

Both polyamide and polyester are useful as plastics as well as fibers and are often classed as engineering polymers. Blends of polyamide and polyester have been considered to be a candidate for excellent polymer alloys [1,2]. However, their blends do not show outstanding properties due to the intrinsic immiscibility [3]. Although lots of efforts have been formed to enhance the miscibility, the results are not always successful. Typical approach used for compatibilization of polyamide and polyester is to add a catalyst, for example, *p-toluenesulfonic*, for accelerating the ester-amide interchange reaction. However, the catalyst may cause the degradation as well as the exchange reaction, and thus we will not get the mechanical properties we may expect.

In this study we investigate the compatibilizing performance of poly(hydroxy ether of bisphenol A), phenoxy, for the blends of polyamide 6 and PET. From the previous works on the miscibility of phenoxy with polyamide 6 and PET, it is expected to be a compatibilizer for immiscible polyamide 6/PET blends [4].

Experimental

All the polymers used for this study are commercially available and dried under vacuum at 60 °C before melt mixing. The details of the polymers used in this study are listed in Table 1.

Table 1. Characteristics of the polymers used in this study

Polymers	Source	T _g (°C)	T _m (°C)	Remarks
Polyamide 6	Samyang Co.	52.4	214.0	-
PET	Samyang Co.	83.3	251.7	-
Phenoxy	Union Carbide Co.	83.9	-	-

Melt blended samples were prepared using a mini molder, Bau BA915. Mixing was done at 280 °C for 5 min. Total amount of samples per batch was 2 g. Ratio of polyamide 6 and PET in blends was fixed at 80/20 or 20/80 by weight and the content of phenoxy added was 0, 10, and 20 wt % of (polyamide 6 + PET), respectively.

Morphology of the blends was observed using a scanning electron microscopy (SEM), Hitachi S-4700. To ascertain whether phenoxy phase is located at, cryofractured surfaces were etched using THF, a selective solvent for phenoxy for 24 hrs.

Thermal properties of the blends were measured using a differential scanning calorimeter (DSC), Seiko I S200. The data obtained during 2nd scan was used.

Results and Discussion

Figure 1 shows the representative SEM micrographs for 80/20 polyamide 6/PET blends with and without phenoxy. As shown in Figures 1(b) and 1(c), it is clear that phenoxy locates at the interface between nylon and PET and contributes to reduce the minor phase in the matrix of polyamide 6. Such an encapsulation behavior may be interpreted in terms of the spreading coefficient, proposed by Hobbs et al for ternary polymer blends [5]: $\gamma_{Polyamide6/PET} > \gamma_{Polyamide6/phenoxy} + \gamma_{PET/phenoxy}$.

Figure 2 shows the representative DSC thermograms for 80/20 polyamide 6/PET blends with and without phenoxy. Three characteristic transitions, T_g of phenoxy, T_m of polyamide 6, and T_m of PET, are clearly observed for the 80/20/10 blends, indicating that three distinct phases exist in the blends. The transitions do not change compared with those of the pure polymers.

References

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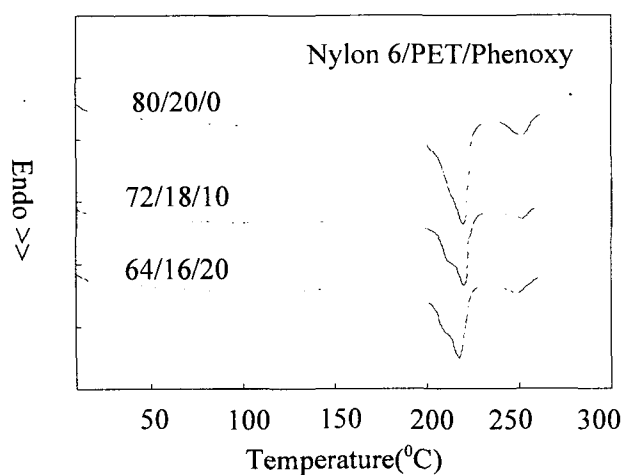


Figure 2. Representative DSC thermograms of 80/20 polyamide/PET blends with and without phenoxy.

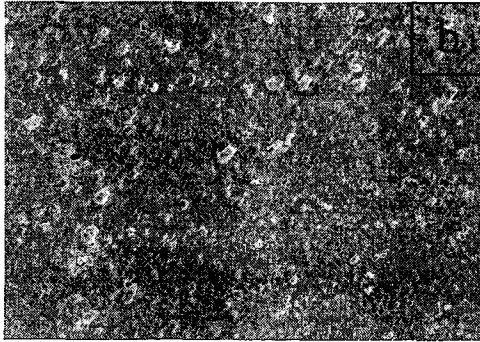
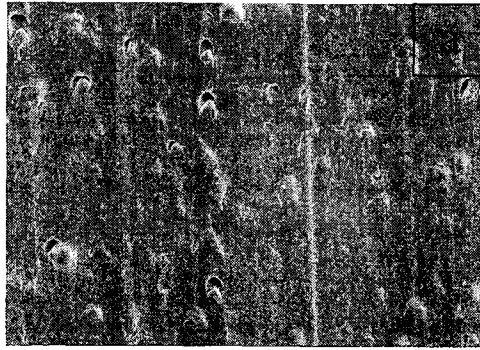


Figure 1. SEM micrographs of 80/20 polyamide/PET blends with and without phenoxy before annealing.