Compatibilizing Effect of [2, 2-Di (4-hydroxy phenyl) propane and 4, 4'-Dihydroxyldiphenylsulfone] Polyesters on the Morphology of Polyethersulfones and Polycarbonates Blends

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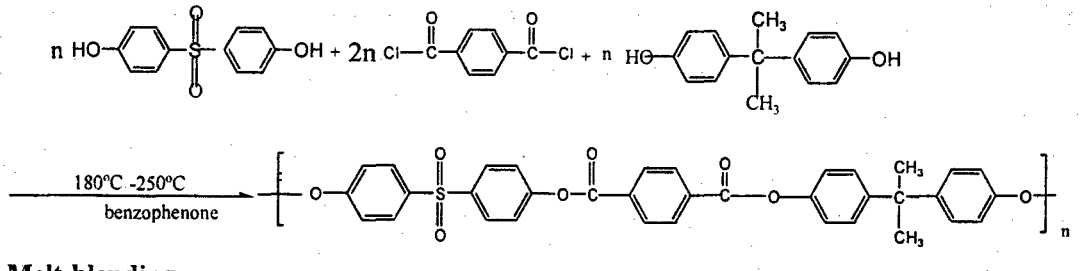
Introduction

Blending existing polymers together has long been known to be an effective, low-coast way of developing novel materials. However, the vast majority of polymer system is mutually immiscible and, when blended, display very poor mechanical properties due to their coarse, heterogeneous morphology and weak adhesion. It is well known that the addition of properly designed block or graft copolymer [1] and random copolymers [2] to immiscible polymer blends is an efficient way to improve the phase dispersion, to stabilize the phase morphology, and to improve the terfacial adhesion. For engineering plastics, for example, polyetheretherketone (PEEK), polyethersulfone (PES) and polycarbonate, it is not easy to design and synthesize suitable block or graft copolymers or to make each pair have appropriate functional groups. A blend of polyethersulfone (PES) and polycarbonate (PC) was studied [3]. It was found that the PES-PC blend is a partially miscible, two-phase system, and an interfacial layer exists between the phase of PES and PC. Here we introduced [2, 2-di (4-hydroxy phenyl) propane and 4, 4'-dihydroxyldiphenylsulfone] Polyesters with a compatibilizer. It will be miscible with PES, PC and can improve theirs miscibility.

Experimental

Synthesis of [2, 2-di (4-hydroxy phenyl) propane and 4, 4'-dihydroxyldiphenylsulfone] Polyesters

2, 2-di (4-hydroxy phenyl) propane and 4, 4'-dihydroxyldiphenylsulfone and p-phthaloyl chloride were prepared via a nucleophilic aromatic substitution reaction, as follows:



Melt-blending

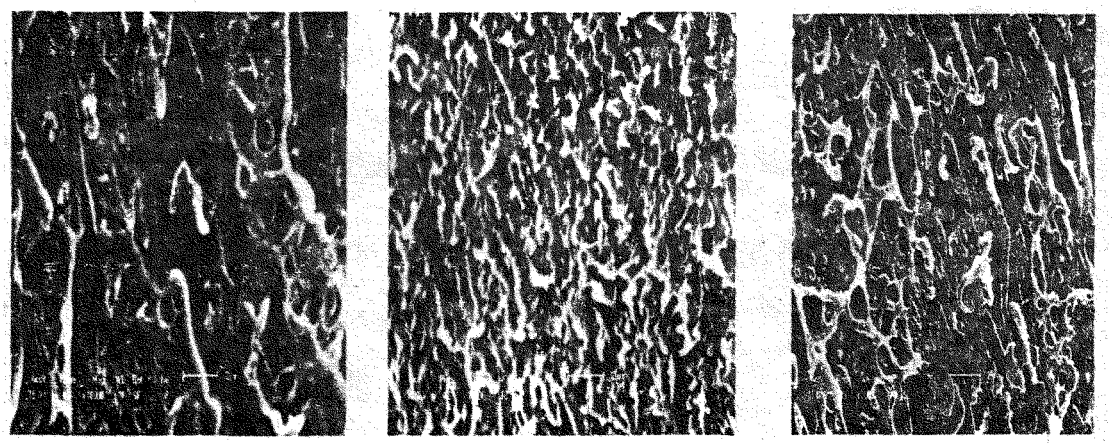
The photopolymer PES, PC and the blend of PES/PC in a weight ratio of 70/30 were prepared using a Brabender-like apparatus (Rheocoder XSS-300) at 300℃,50 rpm, for 10 min.To characterize the miscibility between PES, PC, compatibilizer and the two bulk polymers, PES/PC/compatibilizer: (70/30/1%), (70/30/3%) were also prepared by the same method described above.

Results and Discussion

SEM photomicrographs of the blends are shown in Figure1. For binary blends [Fig.1 (A)], the average particle size of the dispersed is bigger. The detachment of the PC phase from the pes matrix is observed, and there is no indication of adhesion between the two components. When 1%, 3%of compatibilizer was added to the system, the domain size of the dispersed phase was reduced, as shown in Figure 1(A-C). This photomicrograph, in which the strong plastic deformation of the matrix was observed and the shear deformation of PC particles accompanied it, is an indication of the improved adhesion at the interface between the PES and PC phase. In Figure 2, in the case of the system, that PES shifts to low temperature is not obvious, and PC shifts to low temperature. The reason is that there may be a lower molecular weight of compatibilizer. Further investigation is in progress in our laboratory.

Conclusion

Form SEM, studied show that the miscibility of PES-PC melt blending is improving by compatibilizer. The domain size of the dispersed phase is reduced. Therefore, interface tension will reduce by appropriate concentration of compatibilizer. Consequently, miscibility will be improved.



A B C

Fig 1.SEM photographs of the blend systems (magnification × 10000) A, PES/PC (70/30); B, PES/PC/Compatibilizer(70/30/1); C, PES/PC/Compatibilizer(70/30/3).

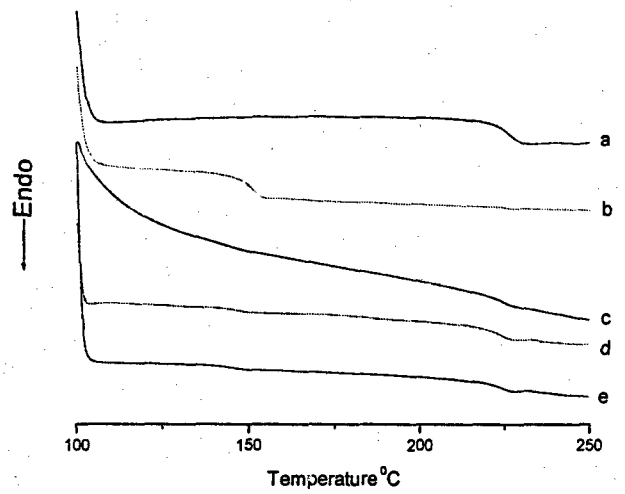


Fig 2. DSC curves of blend systems PES/PC/Compatibilizer (a)100/0/0(b)0/100/0(c)70/30/0(d)70/30/1(e)70/30/3

References

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