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Effect of molecular weight of functionalized polystyrene on the compatibility of blends of polyamide 6 and polystyrene

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The effect of polystyrene modified with maleic anhydride (MPS) on the compatibility of the immiscible blends of polyamide 6 and polystyrene was investigated as a function of the molecular weight of MPS. The MPS was prepared by melt extrusion in a twin screw extruder and the content of maleic anhydride in the MPS was below 1 wt%. The compatibilizing ability of the MPS was examined through several experimental techniques such as scanning electron microscopy and measurements of mechanical and rheological properties. The interfacial adhesion between two separated phases was also measured using a butt joint test. The compatibilizing ability of the MPS was very dependent on the molecular weight of the MPS. The MPS of high molecular weight seems to be more effective in reducing the domain size of dispersed phase and in increasing the interfacial adhesion. Copyright © 1996 Elsevier Science Ltd.

(Keywords: functionalized polystyrene; compatibility; polystyrene/polyamide 6 blends)

INTRODUCTION

Immiscible polymer blends are characterized by a two-phase morphology, a narrow interface, and poor physical/chemical interactions across the phase boundaries, and thus often poor mechanical properties. To obtain polymer blends with desirable properties, these problems must be alleviated by appropriate methods. The addition of a compatibilizer capable of physical or chemical interactions with the blend constituents provides an effective method to overcome the problems of immiscible polymer blends[1]. In general, block or graft copolymers of appropriate chemical structure have been utilized as a polymeric compatibilizer.

Polymeric compatibilizers may be classified into two types according to their method of addition, separate addition type and *in situ* formation type. In the separate addition type, block or graft copolymers, which are prepared in a separate step, are added into immiscible blends. Normally they possess segments having chemical structures which are identical with those of the homopolymers being blended[2–4]. In this case the compatibilizing efficiency of copolymers added is very dependent on their molecular weight and the molecular architecture of the copolymers. As far as molecular weight is concerned, the molecular weights of arms of the copolymers should be long enough to anchor the copolymer to the homopolymer, but short enough to minimize the amount of added compatibilizer. Since a possibility that the copolymers preferentially locate at the interfaces is controlled by two different forces, the thermodynamic 'driving force' to the interface and the kinetic 'resistive force' to diffusion, it is very important to investigate how these two forces vary with molecular weight of the copolymer and processing variables[5]. Recently the importance of the miscibility of arms of the block or graft copolymers with homopolymers has been extensively studied in our laboratory[6–9]. In this case molecular weight of arms of the copolymers is not important for compatibilizing immiscible blends.

In situ reactive compatibilization is an alternative to replacing the method of adding block or graft copolymers separately. When suitable functionalized polymers are melt-mixed with immiscible polymer blends, a block of graft copolymers can be formed through the reaction between the functionalized polymer and blend components. Usually the copolymers formed during processing have segments that are chemically identical to those in the respective unreacted homopolymers and that are thought to be located preferentially at the interface. In this reactive case, the structure of the copolymers formed is controlled by the structure of the functionalized polymers added and the extent of reaction during processing. In this case, kinetic problems such as the reactivity of functional groups during processing become very important for effective compatibilization. The reactions of amines and anhydrides have sufficiently fast kinetics in the melt to provide technologically useful alloys[10]. Therefore, the use of this reaction for the reactive compatibilization of immiscible polymer blends

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has been extensively reported. The details of the compatibilization method used, the compatibilization mechanism, and the types of chemical reactions have been well reviewed[11]. A direct comparison between a separately added and an *in situ* compatibilizer was made by Nakayama *et al.*[12]. They reported that the compatibilization by *in situ* formed copolymers is more effective in reducing the domain size of dispersed phase and stabilizing them than the case by separately added ones.

Although it is generally known that the molecular weight of block copolymer is an important factor for its compatibilizing performance, it is unclear whether, in the reactive case, the molecular weight of the reactive compatibilizer has the same effect as that of the block copolymer added. In this paper, therefore, we examine the effect of molecular weight of functionalized polymers on the compatibility enhancement of immiscible polymer blends.

EXPERIMENTAL

Materials

Three polystyrenes (PSs) of different molecular weights were used for the grafting of maleic anhydride (MAH): two PSs are synthesized in this study and one PS is obtained as a commercial grade from Hannam Chemical Co. PSs were grafted with maleic anhydride through reactive extrusion in a Brabender twin screw extruder. The details of the reaction conditions are described in a previous paper[13]. *Table 1* summarizes the characteristics of polymers used in this study. The content of MAH in polystyrene modified with maleic anhydride (MPS) is below 0.7 wt%.

Sample preparation

The pre-dried polymers were melt-mixed in a Brabender mixing head using a rotor type blade. The temperature inside the mixing head was controlled at 230°C and rotor speed was fixed at 60 rpm. The mixing time was fixed at 10 min, since an equilibrium of torque was observed after about 8 min. At the end of the mixing, the blends were immediately collected and quenched for subsequent characterization. Two different blends of polyamide 6 (PA6) and PS, with PA6 composition of 80% and 20% by weight, were prepared. The concentration of MPS in the blends was 5 wt%.

The effect of the mixing sequence on domain size of dispersed phase was investigated using three different mixing orders. In the first method (Method 1), all three components, PA6, PS, and MPS, were simultaneously introduced to the Brabender mixing head. The blends prepared in this manner are designated as PA6/MPS/PS. In the second method (Method 2), two reactive components (MPS and PA6) were melt-blended first and then with the non-reactive component (PS) in the second step. The blends prepared in this manner are designated as (PA6/MPS) + PS. The plus sign denotes a second melt-mixing step. In the third method (Method 3), two non-reactive components (MPS and PS) were melt-blended first, and then with the reactive component (PA6). The blends prepared in this manner are designated as (PS/MPS) + PA6. In Method 3, PA6 was pre-treated under the same conditions as the mixing conditions in order to eliminate thermal history.

Morphological observation

The morphology of blends was observed with a scanning electron microscope (SEM, JEOL JSM-840A) at an accelerating voltage of 25 kV. After the blend samples were fractured at the liquid nitrogen temperature, the fractured surface was coated with gold. To remove the minor phase in the blends, a solvent extraction method was used, if necessary. Tetrahydrofuran (to remove the PS phase) or formic acid (to remove the PA6 phase) was used as a solvent.

High contrast SEM micrographs were analysed to determine the particle size distribution of the dispersed phase by an image analyser with Ultimage software. The Waddel diameter (diameter of a circle having the equivalent area of a non-round shape) of each particle was computed. On average 600–800 diameter measurements were taken per blend. The number ($\overline{D}_n$) and weight-average diameters ($\overline{D}_w$) of the dispersed particles were calculated from the following relationships:

$$\overline{D}_n = \frac{\sum N_i D_i}{\sum N_i} \qquad (1)$$

$$\overline{D}_w = \frac{\sum N_i D_i^2}{\sum N_i D_i} \qquad (2)$$

where N_i is the number of particles having the diameter of D_i.

Rheological measurement

The dynamic rheological properties of homopolymers and blends were measured at 230°C using a rheometer

Table 1 Polymers used in this study

Designation	Source	$\overline{M}_n$ ($\times 10^3$)	$\overline{M}_w$ ($\times 10^3$)	MAH content[a] (wt%)
PA6	Tongyang Nylon Co.	25	–	–
PS	Hannam Chemical Co.	115	306	–
L-MPS1	our laboratory	15	59	0.47
L-MPS2	our laboratory	20	66	0.57
M-MPS1	our laboratory	64	217	0.52
M-MPS2	our laboratory	68	175	0.68
H-MPS1	our laboratory	100	228	0.08
H-MPS2	our laboratory	125	262	0.28

[a] Determined from acid value

(Rheometrics RMS 800) with a parallel plate mode under a nitrogen atmosphere. The plate diameter was 25 mm and the gap between the two plates was fixed at 2 mm. Strain was maintained at 10%.

Tensile properties

Dumb-bell type specimens were tested on a tensile tester (Instron Model 1445). All tests were performed at a cross-head speed of 2 mm min^{-1} and a temperature of 20°C. At least seven specimens of each blend were tested, and the average value was reported as experimental data. The test specimens were prepared at 230°C using the Mini Max moulder (CS-183MMV, Custom Scientific Instruments).

Determination of interfacial adhesion

To examine the effect of MPS on the interfacial adhesion between PA6 and PS phase, a butt joint test (ASTM D897) was performed in a tensile tester at a cross-head speed of 5 mm min^{-1}. Two types of test specimens were prepared to elucidate the compatibilizing mechanism of MPS. In the first, PS was used for the two outer layers while the blend of PA6 and MPS (80/20 by weight) was the inner layer of the three-piece sandwich. In the second, PA6 was used for the two outer layers while the blend of PS and MPS (80/20 by weight) was the inner layer of the three-piece sandwich.

PA6 homopolymer and the blends of PA6 and MPS were compression moulded at 230°C and 250 psi. On the contrary, PS homopolymer and the blends of PS and MPS were compression moulded at 200°C and 250 psi. The dimension of the outer layers was 120 × 100 × 5 mm. The dimension of the inner layers (PA6/MPS or PS/MPS) was 120 × 100 × 1 mm. The prepared sheets were placed in a vacuum oven overnight at 80°C to relax residual stresses.

Three-layer laminates were made by bonding the outer substrates and the inner sheets for 60 min at 230°C in a compression press. The laminates were cut into 10 × 5 × 11 mm sections using a band saw. At least seven specimens of each case were tested, and the average value was reported.

RESULTS AND DISCUSSION

Effect of molecular weight of MPS

Figure 1 shows the morphology change of 80/20 PA6/PS blends when the 5 wt% MPSs were added. The SEM micrograph of the etched surface of the PA6/PS blend (*Figure 1A*) shows the typical morphology of an incompatible blend with a very large domain size and smooth fracture surface. The size of dispersed PS domains ranges from 1 μm to 6 μm. The addition of 5 wt% MPS not only reduces the PS domain size in the blends, but produces a more uniform particle size distribution. When a series of H-MPS is added to the blends, the morphology changes dramatically into a more uniform and finer dispersion (*Figures 1F* and *1G*), while the addition of one of L-MPS or M-MPS series results in a slight to moderate decrease of domain size (*Figures 1B–1E*).

The ratios of the particle diameter of the blend with 5 wt% MPS to that of the uncompatibilized blend (D_{mi}/D_0) in 80/20 PA6/PS blends, obtained from the micrographs of *Figure 1*, are summarized in *Table 2*.The reduced diameter indicates the effectiveness of the compatibilizers added. As seen in *Table 2*, the particle size reduction depends significantly on the type of functionalized polystyrene added. Especially, the molecular weight of MPS is very important for compatibilizing the immiscible PA6/PS blend. *Table 2* shows that a series of H-MPS are more effective than other series of MPS in reducing the domain size of PS in the blends. Besides the molecular weight of MPS, the content of MAH in the MPS may be another parameter controlling the size of dispersion phase. However, the domain size seems to be little affected by the MAH content in the range of 0.1–0.7 wt%.

Figure 2 shows SEMs of 20/80 PA6/PS blends when 5 wt% of various MPSs were added. The D_{mi}/D_0 ratios of 20/80 PA6/PS blends are also summarized in *Table 2*. The domain size shows no large difference between the blends with the relatively low molecular weight MPS (L-MPS and M-MPS) and the blend without compatibilizer. On the other hand, the addition of high molecular weight MPS (H-MPS series) reduces particle size and makes the particle size distribution narrow. This observation is very similar to the compatibilization by block copolymers added separately. It is generally known that high molecular weight block copolymer lowers the interfacial tension more effectively than low molecular weight copolymer does when the same amount of block copolymer is added[14,15].

Effect of mixing sequence

In the case of reactive compatibilization, the particle size of compatibilized blends is dependent on the mixing sequence. Recently, the effect of a mixing sequence on domain size has been reported by several authors[16–18]. It is generally known that two-step mixing is more effective in reducing the particle size than one-step mixing. Two-step mixing was performed by first preparing a master

Table 2 Variation of domain size with the type of compatibilizer added

Blends	Compatibilizer	D_{mi}/D_0[a]	Blends	Compatibilizer	D_{mi}/D_0[a]
80/20 PA6/PS	L-MPS1	0.86	20/80 PA6/PS	L-MPS1	0.92
	L-MPS2	0.59		L-MPS2	0.70
	M-MPS1	0.65		M-MPS1	0.67
	M-MPS2	0.57		M-MPS2	0.65
	H-MPS1	0.17		H-MPS1	0.14
	H-MPS2	0.11		H-MPS2	0.14

[a] D_{mi}/D_0 is the ratio of particle diameter of blends containing 5 wt% MPS to that of the uncompatibilized blend

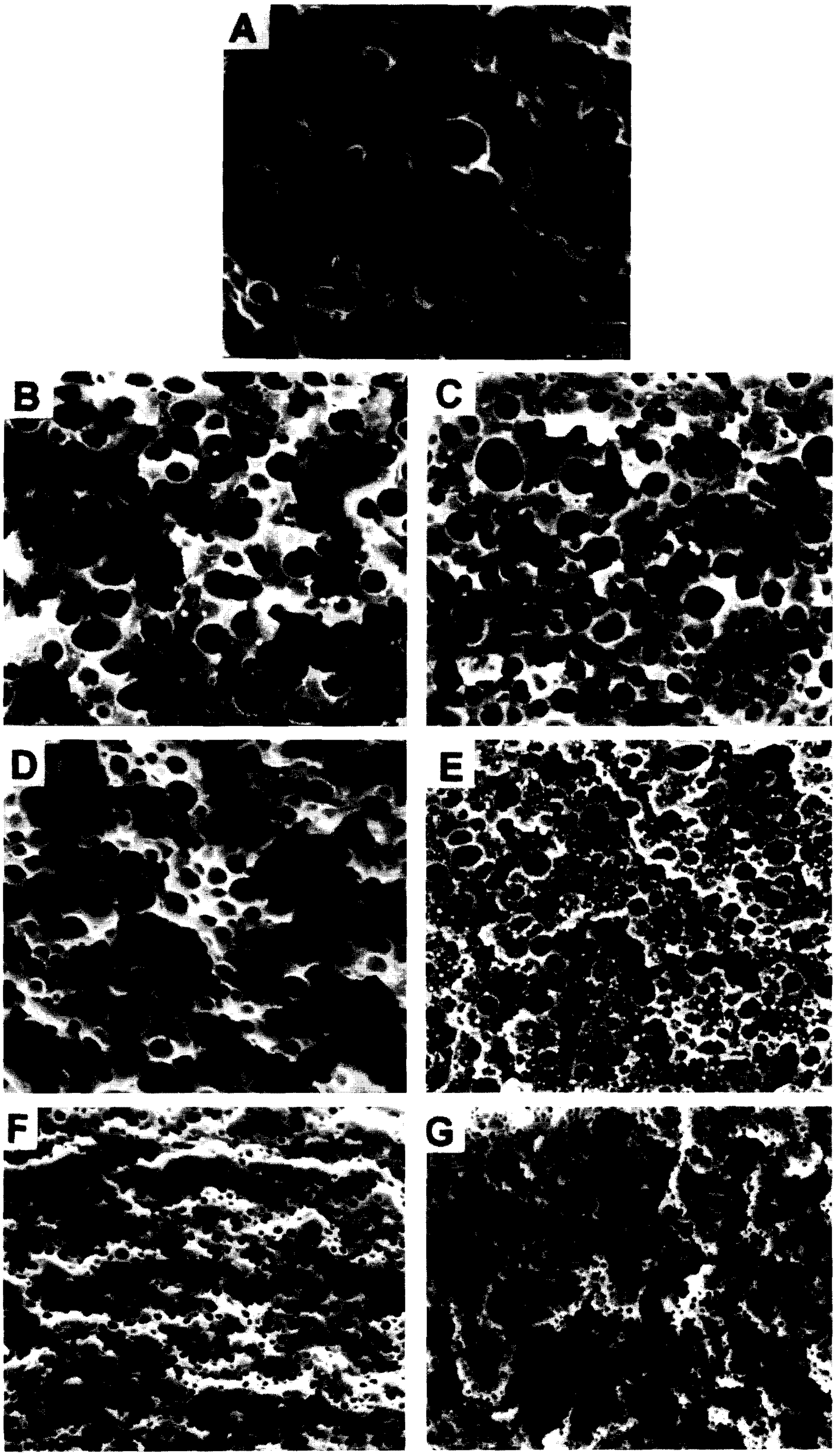

Figure 1 Scanning electron micrographs of fractured surfaces of 80/20 PA6/PS blends with and without 5 wt% MPS: (A) without MPS; (B) L-MPS1; (C) L-MPS2; (D) M-MPS1; (E) M-MPS2; (F) H-MPS1; (G) H-MPS2

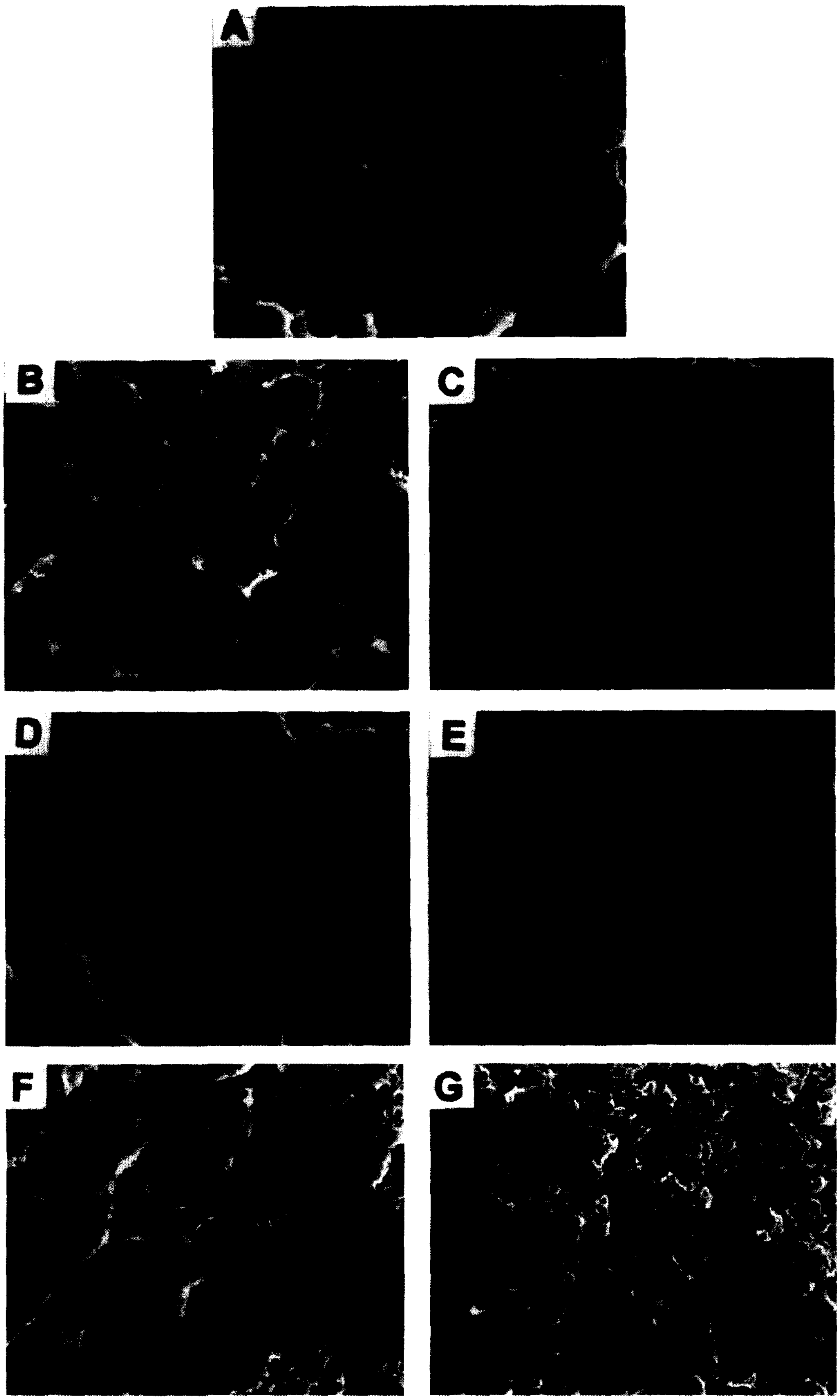

Figure 2 Scanning electron micrographs of fractured surfaces of 20/80 PA6/PS blends with and without 5 wt% MPS: (A) without MPS; (B) L-MPS1; (C) L-MPS2; (D) M-MPS1; (E) M-MPS2; (F) H-MPS1; (G) H-MPS2

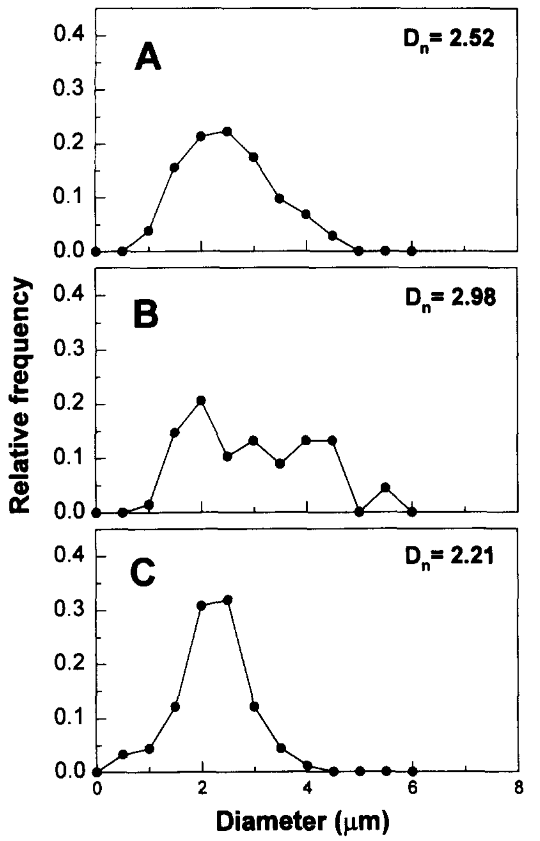

Figure 3 Effect of the mixing sequence on the particle size distribution when L-MPS1 was added to 80/20 PA6/PS blends: (A) Method 1; (B) Method 2; (C) Method 3. D_n is the number average particle diameter of the dispersed phase

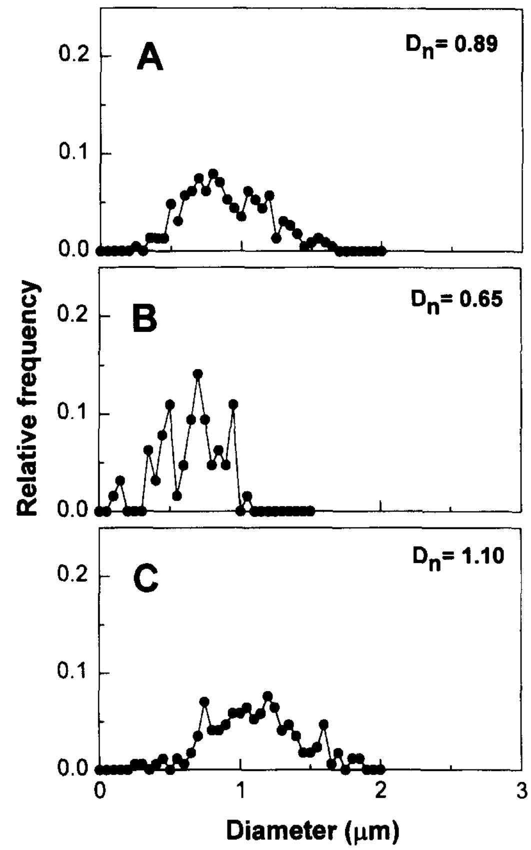

Figure 4 Effect of mixing sequence on the particle size distribution when M-MPS1 was added to 80/20 PA6/PS blends: (A) Method 1; (B) Method 2; (C) Method 3. D_n is the number average particle diameter of the dispersed phase

batch of the polymer destined to be the minor phase containing the interfacial agent. This master batch was then compounded with the matrix polymer. By concentrating the interfacial agent directly in the polymer that would subsequently be the minor phase, the interactions that occur across the interface could be increased more readily.

Figure 3 shows the effect of the mixing sequence on particle size of dispersed phase for PA6/PS (80/20) blends when a low molecular weight MPS, L-MPS1, was added. The size of the dispersed PS domain is in the order of (PA6/MPS) + PS > PA6/MPS/PS > (PS/MPS) + PA6. In other words, the effectiveness in reducing the particle size is in the order of (PS/MPS) + PA6 > PA6/MPS/PS > (PA6 + MPS) + PS.

In Method 2, denoted as (PA6/MPS) + PS, copolymers of PS-*g*-PA6 are formed during the first blending and thus most of the MAH unit in MPS can react with the end groups of PA6, resulting in the highest abundance of PS-*g*-PA6 copolymers of the three methods. However, although it involves a high probability of formation of the PS-*g*-PA6 copolymers, Method 2 was least effective in reducing the particle size. This may be explained by the following consideration. The copolymers formed in the first step must move away from the interface to act as a compatibilizer. When the molecular weight of MPS is relatively low, there is a possibility of trapping the copolymers in the PA6 matrix due to a certain degree of compatibility. According to de Gennes[10], the degree of incompatibility is defined as χN, where χ and N denote the Flory–Huggins interaction parameter between blend components and the degree of polymerization, respectively. The large value of χN induces the phase segregation. Since the value of χ is only related to the segmental interaction between the two species, the PS component in the PS-*g*-PA6 copolymer and PA6 matrix, χN decreases with decreasing the molecular weight of the PS component. Therefore, it is possible that the PS-*g*-PA6 graft copolymers, formed from the low molecular weight MPS, is dissolved in the PA6 matrix. The trapped copolymers are ineffective in reducing the domain size.

In Method 3, denoted as (PS/MPS) + PA6, where PS-*g*-PA6 copolymers are formed during the second process, most of the copolymers formed can stay near the interface although the amount of the copolymer formed is relatively small. Therefore, when the MPS of low molecular weight was added, the PS-*g*-PA6 copolymers formed in this process could reveal the highest effectiveness in reducing the domain size as a compatibilizer. The effectiveness of one-step blending for compatibilization lies between those of the other two methods.

Figure 4 shows the influence of mixing protocol on domain size for PA6/PS (80/20) blends when a high molecular weight MPS, H-MPS1, was added. The size of the dispersed PS domain is in order of (PS/MPS) + PA6 > PA6/MPS/PS > (PA6/MPS) + PS. The reverse of this order is directly related to the order of the amount of the copolymers formed during mixing. For H-MPS1, one can expect that most of the copolymers formed diffuse to near the interface, since the repulsion between the PS component in the PS-*g*-PA6

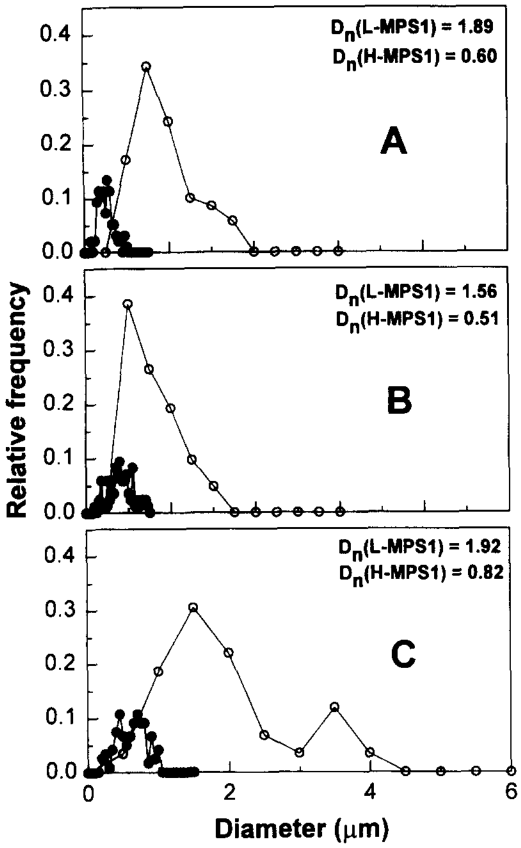

Figure 5 Effect of the mixing sequence on the particle size distribution in 20/80 PA6/PS blends: (A) Method 1; (B) Method 2; (C) Method 3. Open and filled circles denote the blends with L-MPS1 and H-MPS1, respectively. D_n is the number average particle diameter of dispersed phase

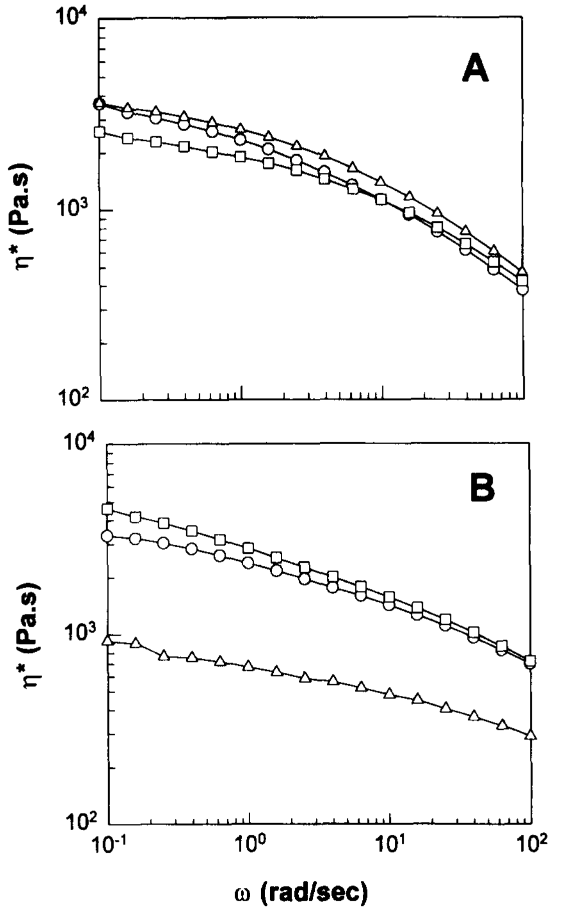

Figure 6 Variation of complex viscosities with the type of the mixing sequence in 80/20 PA6/PS blends containing 5 wt% L-MPS1 (A) and H-MPS1 (B): (○) Method 1; (□) Method 2; (△) Method 3

copolymers and PA6 matrix is very large due to the large value of χN. Therefore, the domain size is significantly reduced in Method 2.

Figure 5 shows the effect of mixing order on domain size for the PS matrix blends. The size of the dispersed PA6 domain is in the order of (PS/MPS) + PA6 > PA6/MPS/PS > (PA6/MPS) + PS. This is the same order as that in *Figure 4* (the addition of H-MPS1 to the PA6 matrix blend). Irrespective of the molecular weight of MPS, the best method to reduce the mean radius of the dispersed domain is Method 2, i.e. the MPS was first added into a reactive component (PA6) and the mixture was then added to a non-reactive component (PS). When the PS phase is matrix, the difference of the molecular weight of MPS does not change the order of the three mixing methods. When the *in situ* compatibilizer is formed in the dispersed phase, the possibility of being trapped in the dispersed phase decreases considerably. Therefore, most copolymers formed in the first step diffuse to near the interface during the second step. Therefore, the result obtained from the PS matrix blends is different from that of the PA6 matrix blends.

Rheological properties

Figure 6 shows the variation of the complex viscosities of 80/20 PA6/PS blends with the types of the mixing sequence when the two different MPSs, L-MPS1 and H-MPS1, are added, respectively. When a low molecular weight MPS, L-MPS1, is added, the blend prepared by Method 3 has the largest viscosity and the viscosities of the blends increase according to the following order: (PS/MPS) + PA6 > PA6/MPS/PS > (PA6/MPS) + PS. This order is consistent with that of effectiveness in reducing the domain size, *Figure 3*. On the other hand, when a high molecular weight MPS, H-MPS1, was added, the order of an increase in viscosity is as follows: (PA6/MPS) + PS > PA6/MPS/PS > (PS/MPS) + PA6. This result is also consistent with that of morphology observation of *Figure 4*.

Figure 7 shows the variation of the complex viscosities of the PS matrix blends with the types of the mixing sequence. Irrespective of the molecular weight of MPS, the blends prepared by Method 2 has the largest viscosity. Also, the order of an increase in the viscosity is the same as that of the effectiveness in reducing the domain size.

Tensile properties

The tensile properties of 80/20 PA6/PS blends with and without MPS were summarized in *Table 3*. When 5 wt% MPS is added, both tensile strength and Young's modulus marginally increase by 5–10%. The improvement of strength and modulus may be attributed to both domain size reduction and the interfacial adhesion. The tensile properties of these blends do not change much with the type of compatibilizer added.

Table 3 also lists the tensile properties of 20/80 PA6/PS blends. Unlike the result of the PA6 matrix blends, the addition of 5 wt% MPS lowers both tensile strength and Young's modulus of the blends. The decrease in tensile

Table 3 Tensile properties of PA6/PS blends with and without compatibilizer

Blends	Compatibilizer	Young's modulus (MPa)	Tensile strength (MPa)	Elongation (%)
80/20	without MPS	216 ± 23	51.9 ± 0.3	108 ± 9
PA6/PS	L-MPS1	241 ± 29	53.1 ± 1.3	100 ± 6
	L-MPS2	217 ± 27	55.5 ± 0.3	101 ± 2
	M-MPS1	230 ± 8	52.0 ± 1.5	110 ± 7
	M-MPS2	212 ± 18	54.1 ± 0.6	111 ± 4
	H-MPS1	222 ± 13	54.4 ± 0.6	128 ± 14
	H-MPS2	246 ± 11	59.2 ± 0.6	127 ± 6
20/80	without MPS	239 ± 10	39.0 ± 2.7	—
PA6/PS	L-MPS1	231 ± 13	36.4 ± 2.1	—
	L-MPS2	236 ± 3	35.7 ± 2.4	—
	M-MPS1	225 ± 6	37.7 ± 1.2	—
	M-MPS2	232 ± 5	37.9 ± 1.4	—
	H-MPS1	220 ± 17	31.5 ± 2.4	—
	H-MPS2	217 ± 15	31.3 ± 2.6	

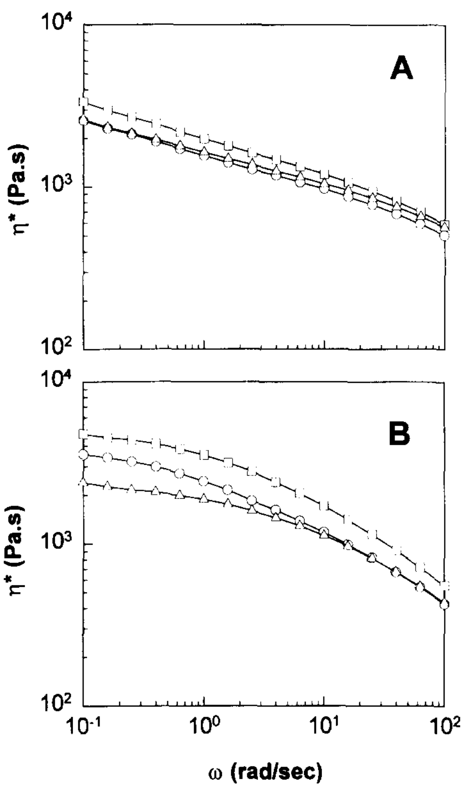

Figure 7 Variation of complex viscosities with the type of the mixing sequence in 20/80 PA6/PS blends containing 5 wt% L-MPS1 (A) and H-MPS1 (B): (○) Method 1; (□) Method 2; (△) Method 3

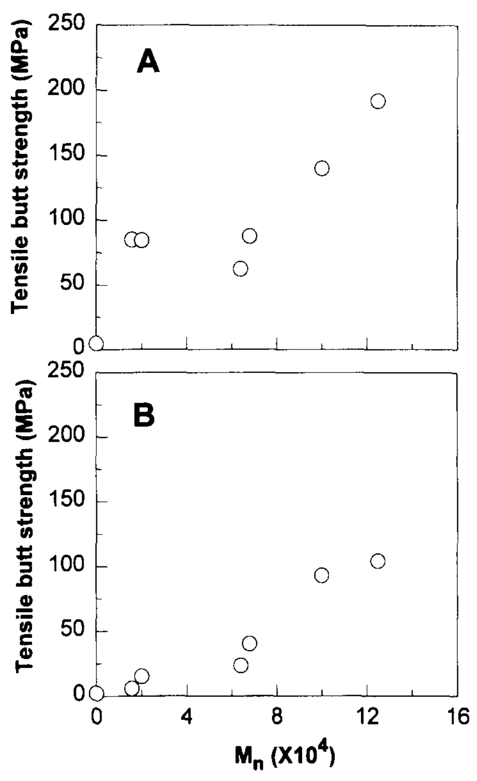

Figure 8 Effect of the molecular weight of MPS on the tensile strength: (A) PA6/(PS/MPS)/PA6 adhesive joint; (B) PS/(PA6/MPS)/PS adhesive joint

strength and Young's modulus is presumably due to the plasticizing effect of PA6. This plasticization effect explains why an improvement in dispersion does not yield an improvement in tensile properties.

Interfacial adhesion

The effect of MPS added on the interfacial adhesion of the immiscible PA6/PS blends was measured by using a butt joint method. The basic principle of this method is given by Wu[20]. The welding temperature and time are important factors for preparing the test specimen. Since PA6 is semicrystalline polymer, the welding temperature was 230°C, just above the melting temperature of PA6. The welding time was set at 60 min, since the tensile butt strength remains constant after 60 min.

Figure 8A shows the tensile butt strength for PA6/(PS/MPS)/PA6 adhesive joint as a function of the number average molecular weight, $\overline{M}_n$, of MPS. There is a significant increase in the tensile butt strength when MPS is added into the inner layer. The tensile butt strength increases with increasing $\overline{M}_n$. This result implies that *in situ* copolymers are formed at the interface and then the copolymers increase the interfacial strength.

The tensile butt strengths for PS/(PA6/MPS)/PS adhesive joint are plotted in *Figure 8B* against $\overline{M}_n$ of MPS. The tensile butt strength is very weak when the relatively low molecular weight MPSs (L-MPS and M-MPS) are added as compared with *Figure 8A*. It seems to be attributed to the shortage of entanglement between PS chain in PS-*g*-PA6 copolymer and bulk PS chains. However, there is a significant increase in the tensile butt strength when high molecular MPSs are added into the inner layer. It is clear that the molecular weight of the compatibilizer is important for the interfacial adhesion.

On closer investigation, one can see that the slope of *Figure 8A* is much steeper than that of *Figure 8B*. This means that the interfacial adhesive strength caused by chemical reaction at the interface between pre-blended PS/MPS and PA6 is higher than that caused by the diffusion of graft copolymers from pre-blended PA6/MPS to PS bulk phase. This difference can be explained as follows. For the systems of PS/(PA6/MPS)/PS, to enhance the interfacial adhesion, the PS component in the PS-*g*-PA6 graft copolymer formed during processing must diffuse from the bulk phase of PA6 (inner layer) to the interface of bulk PS phase (the outer layer). Since the PA6 chains attached to the graft copolymers reduce the mobility of PS chains and restrict the diffusion to the bulk PS phase, the PS-*g*-PA6 copolymers cannot diffuse as fast as unreacted MPS. In this case, most of the PS chains can be trapped within the inner layer. As a consequence, the concentration of grafter copolymers at the interface is low and thus the interfacial adhesion becomes relatively weak.

For the systems of PA6/(PS/MPS)/PA6, the MAH units in the MPS exist at the interface for the reaction with PA6 to yield PS-*g*-PA6. In this case, the concentration of PS-*g*-PA6 at the interface is directly related to the concentration of MPS in PS/MPS phase. The concentration of graft copolymers at the face must be higher in the PA6/(PS/MPS)/PA6 system than in the PS/(PA6/MPS)/PS system. Therefore, the interfacial adhesion of PA6/(PS/MPS)/PA6 system is higher than that of PS/(PA6/MPS)/PS system.

CONCLUSION

This study has focused on the reactive compatibilization of immiscible PS/PA6 blends using PS modified with maleic anhydride. Especially, the compatibilizing effect of the MPS was investigated as a function of molecular weight of the MPS. It was clear from the morphology observation that, although the content of MAH in the MPS is low, the MPS acts effectively as a reactive compatibilizer. The compatibilizing ability of the MPS was very dependent on the molecular weight of the MPS. The high molecular weight MPSs were more effective in reducing and stabilizing the domain size of dispersed phase than the relatively low molecular weight MPSs. The effects of the MPS on the interfacial adhesion between PA6 and PS were also examined through a butt joint test. The relatively low molecular weight MPSs do not increase the adhesion strength as much as high molecular weight MPSs do. From the above results, it was realized that the molecular weight of the MPS was an important factor for controlling the compatibility of the blends of PA6 and PS. High molecular weight MPSs are more effective than low molecular weight MPSs. However, it is not clear whether this effectiveness comes from the molecular weight of the MPS or chain length between the two functional groups of MAH within the MPS. To elucidate whether reactive compatibilizers of high molecular weight are still effective at a higher content of the functional group, more detailed results will be reported soon.

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